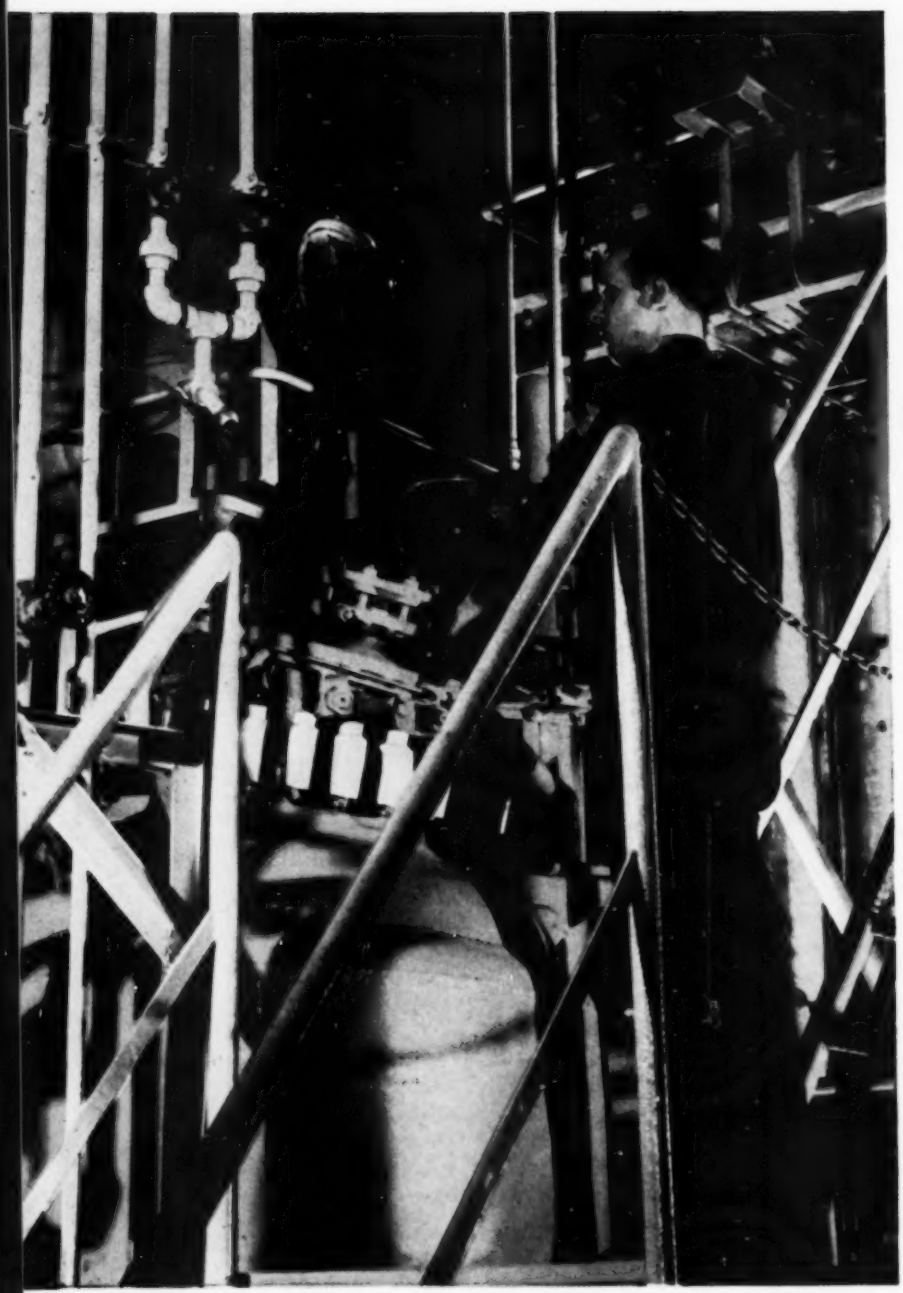
Industry and Power



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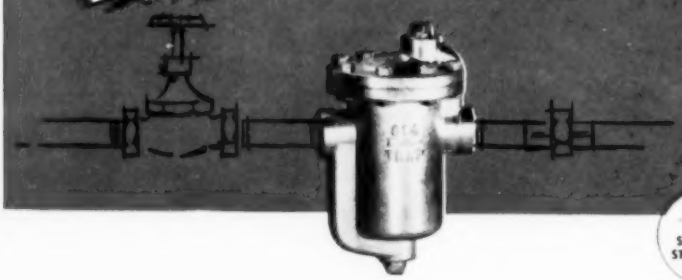
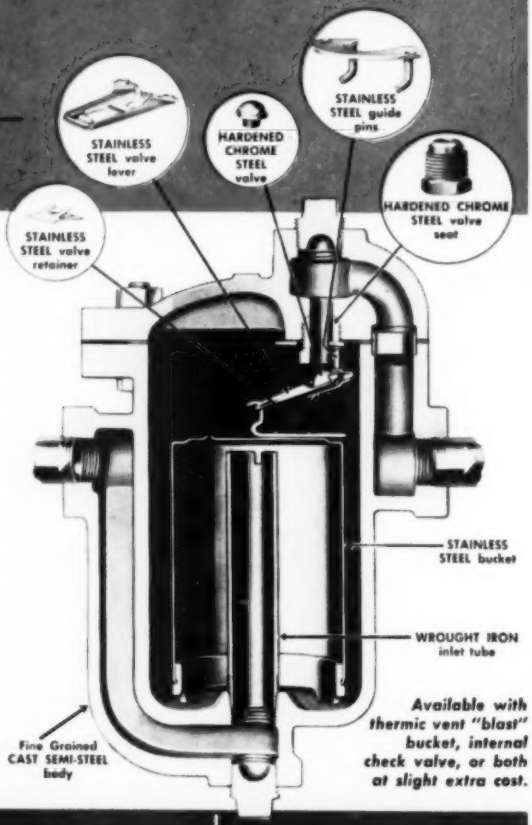
— for engineered plant services

NEW

ARMSTRONG No. 814

. . . a side inlet-side outlet steam trap with 1" or 1¼" pipe connections!




STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
HARDENED CHROME STEEL valve seat
STAINLESS STEEL valve retainer
STAINLESS STEEL bucket
WROUGHT IRON inlet tube
Fine Grained CAST SEMI-STEEL body

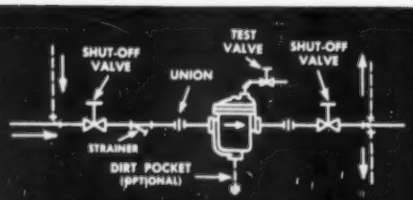
NOW, with the addition of the No. 814, you have a choice of five sizes of Armstrong side inlet-side outlet traps from ½" to 1¼" for use wherever horizontal and opposite pipe connections will make the simplest hookups. Bottom inlet-top outlet traps are available in the same size range, so that for the majority of all condensate loads you can use the body style that best suits the job.

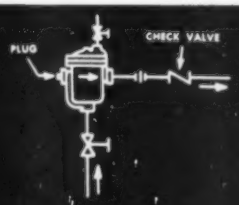
Capacity of the new No. 814 is 6500 lbs./hr. at 125 psig.; height 13⅝"; face to face dimension 8"; weight 45 lbs.; price $46.00 list.

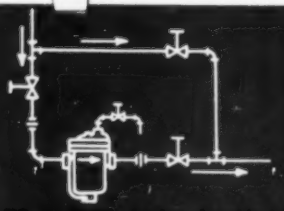
For complete data on the No. 814 and other Armstrong traps, call your Armstrong Representative or mail the coupon today.

Available with thermic vent "blast" bucket, internal check valve, or both at slight extra cost.

ARMSTRONG MACHINE WORKS
820 Maple St., Three Rivers, Mich.







HOW TO ORDER:

Refer to Armstrong Catalog J, Sweets' Plant Engineering or Industrial Construction Files or Chemical Engineering Catalog. Capacities of the 814 are identical to the 214 trap listed in these Catalogs. Other data are given above. Specify trap number, pipe connections and maximum operating pressure.

ARMSTRONG MACHINE WORKS
820 Maple St., Three Rivers, Mich.

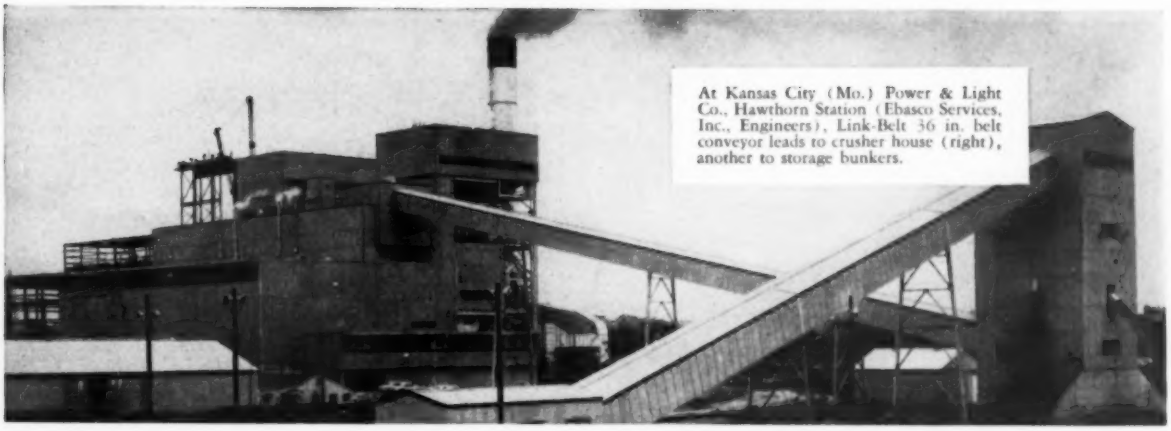
- ☐ Send complete data on No. 814 trap.
- ☐ Send Catalog J listing all Armstrong traps.
- ☐ Have Representative call.

Name_____

Company_____

Street Address_____

City_____ Zone____ State_____



At Kansas City (Mo.) Power & Light Co., Hawthorn Station (Ebasco Services, Inc., Engineers), Link-Belt 36 in. belt conveyor leads to crusher house (right), another to storage bunkers.

For the best in coal handling look to LINK-BELT

IN many power plants—large and small—Link-Belt engineers have met practically every type of coal handling problem. This vast experience, combined with the most complete line of coal handling equipment, is your assurance of the right system for your needs. Our engineers will work with you and your consultants—help you cut coal handling costs to a minimum. Write for 44-page Book 2410, containing drawings and photographs of many outstanding coal handling systems.

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

LINK-BELT

COAL HANDLING EQUIPMENT

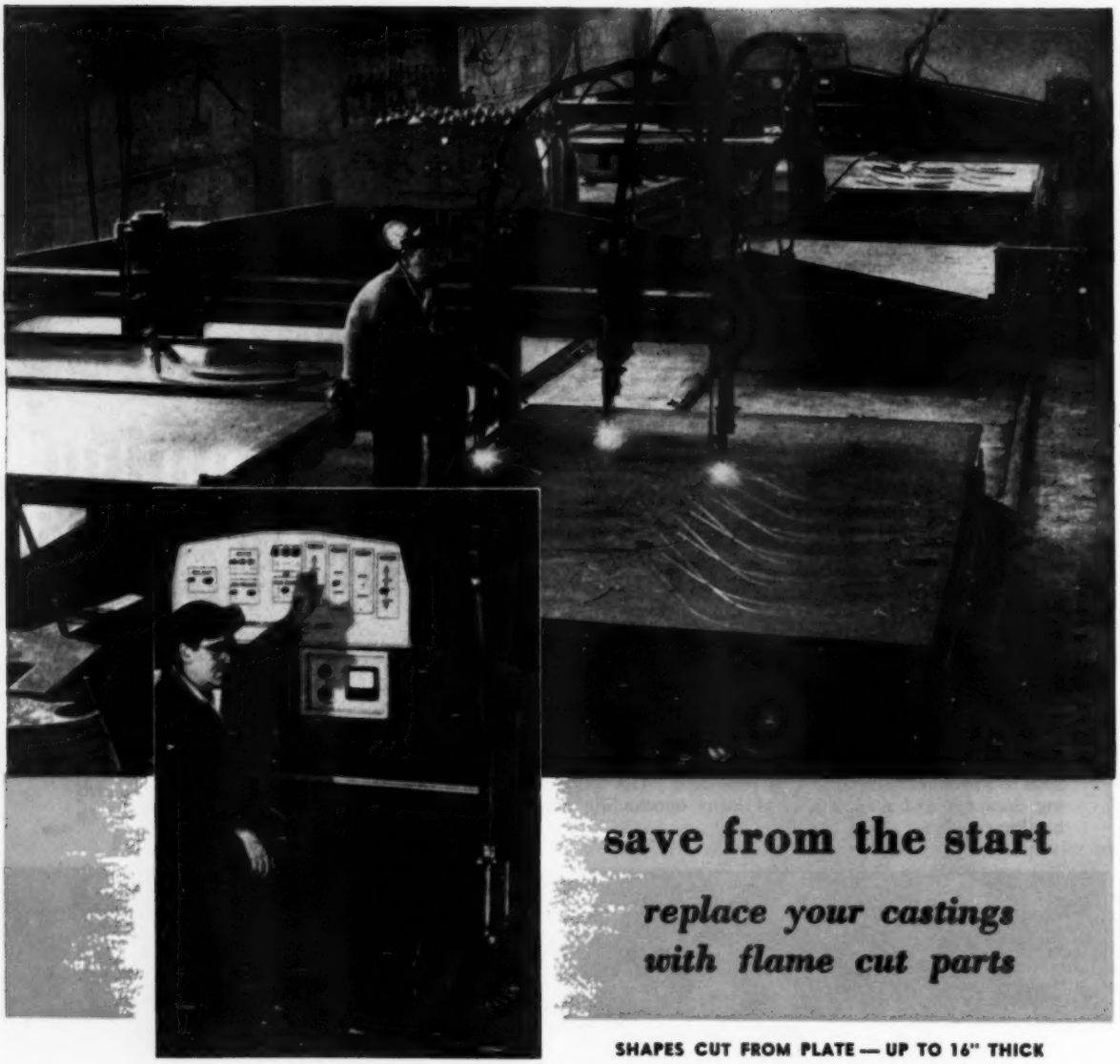
13,255

Two Link-Belt double reciprocating feeders empty track receiving hoppers. Two belts feed another leading to crusher house.

One of two Link-Belt belt conveyors emptying track hoppers. At right, belt feeders deliver coal from reclaim hoppers.

Shuttle belt transfers coal to distributing belts or storage bunkers directly. System handles 450 tph with provision for 900 tph.

Self-propelled trippers have bunker seals. Drag chains in steel enclosures collect dribble from conveyor's return run.



save from the start

replace your castings with flame cut parts

SHAPES CUT FROM PLATE — UP TO 16" THICK

If your casting has two flat sides and a perpendicular edge in almost any shape, it can be cut out of steel plate by FOSTER. Flame cut parts are better than castings in some applications because they are lighter in weight, easier to machine, have greater strength, and cost less money. Shown above is a group of National Cylinder Gas flame cutting machines in operation. By using such modern equipment, FOSTER is able to mass produce shape cut parts at reasonable prices. Sometimes a casting can be replaced by a weldment. Two or more parts cut from steel plate and welded together may often present a considerable saving over a similar casting. Any reasonable shape from 1" square to 8 square feet can be cut by FOSTER — to your exact specifications.

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THE FOSTER COMPANY • Stevensville, Michigan

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Industry and Power

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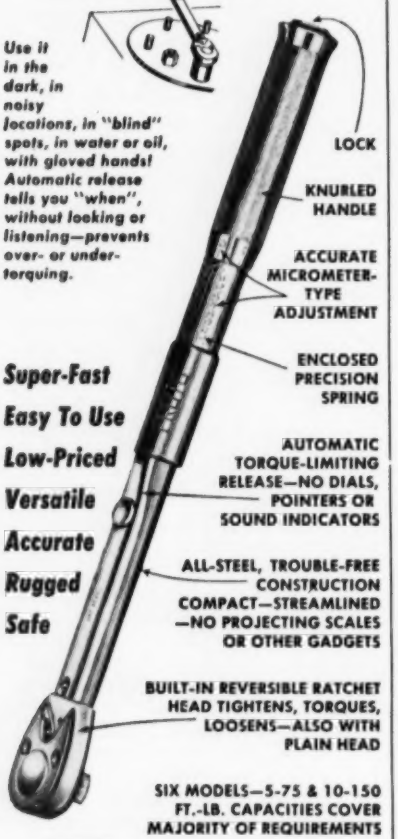
..the Amazing New PROTO Torque-*Limiting* Wrench with Automatic Release!

Use it in the dark, in noisy locations, in "blind" spots, in water or oil, with gloved hands! Automatic release tells you "when", without looking or listening—prevents over- or under-torquing.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Vastly superior to old-fashioned *indicating* types, the new PROTO torque-*limiting* wrench quickly pays for itself by doing work better and faster! See and buy it at your nearest PROTO dealer. Send for free details (enclose 10¢ for 68-page catalog of the *complete* PROTO line) to:

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acorns

. . . recently announced . . . worth watching

Regenerating Pickling Liquor

● A new process for recovering metal pickling liquors uses gaseous hydrochloric acid to precipitate ferrous chloride, regenerating the pickle solution. The ferrous chloride is calcined to give back the hydrochloric acid.

Testing Toxicity

● Beryllium-oxide dusts can cause chemical pneumonia if inhaled. These dusts, varying in toxicity, are becoming more prevalent in industrial atmospheres as the fabrication of beryllium becomes more widespread. A fast, simple method for determining toxicity has been worked out to afford protection in these potentially hazardous atmospheres.

Improving Foundry Sand

● A resin for improving the distribution of clay in foundry sand is announced. One pound of resin will treat one ton of sand, resulting in truer, cleaner, and more economical castings. About 1/16 of the resin is burned out in a pour and must be made up each time the sand is used.

Announcing King-Size Crucibles

● A new process makes possible construction of giant carbon-bonded silicon carbide crucibles, said to be the world's largest. Pots can be made to hold 1100 pounds of aluminum and more of the heavier metals. Greatest demand for the king-size pots is expected to come from the die casting industry.

Studying With Shock

● Miniature shock waves akin to atomic blasts are being created in a shock tube for the study of combustion processes. The device creates shock fronts which travel faster than sound. The front is photographed and studied to determine its effect on combustion in jet engines.

Extruding Steel

● Steel can now be formed into 50-foot or longer rods and pipes of various shapes by extrusion at press speeds of 15 to 20 feet per second. Use of molten glass as a lubricant makes this possible. Because steel must be heated to 2300 F to permit extrusion, only short lengths formerly could be pushed through conventional dies before heat damaged the die. In the new process, a thin film of molten glass is formed around the steel as it passes through the die, reducing wear on the die; it never gets hotter than 600 F. Upon cooling, some of the glass cracks off. A quick dip in dilute hydrofluoric acid cleans off the remaining glass.

Using Rubber Drums

● A synthetic rubber shipping container, developed to compete with glass and metal vessels, has proved adaptable to several unexpected uses. The drums are found suited to transporting petroleum products, antifreeze, cleaning solutions, paints, certain liquid food products, and corrosive liquid chemicals. Chief advantages of the rubber drums are light weight, collapsibility when empty, absence of rust and corrosion, resilience, and releasing of strategic steel. Offsetting these factors are high initial cost, temporarily poor availability, and non-adaptability to existing cleaning and loading machines.

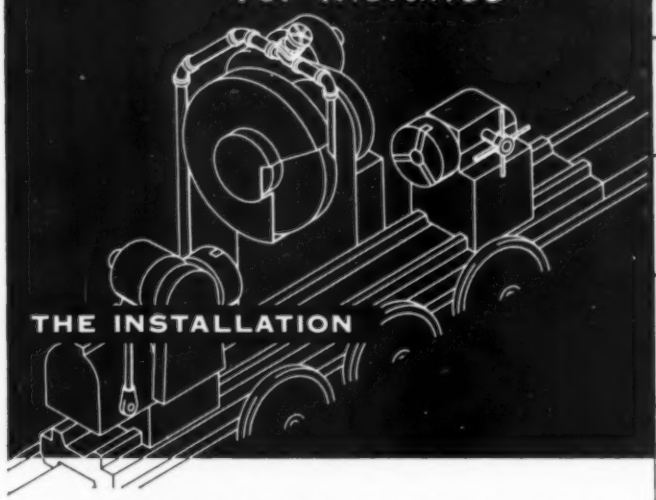
Acetylene Derivatives

● Research has paid off in the production of four new alcohols and glycols previously unobtainable in commercial quantities—methyl butynol, methyl pentynol, dimethyl hexynediol, and dimethyl octynediol. These chemicals are extremely promising as intermediates in the production of polymers, insecticides, fungicides, and pharmaceuticals.

Manufacturing Silicon

● A new process has been developed to manufacture pure silicon. A virtually unlimited source of the element is thus available making its potential applications much broader. Because of its wide range of working temperature, it is expected that creating the new source of pure silicon will spur competition with other materials. It is already suggested that silicon will compete with germanium in transistor manufacture. Silicon works well at 400 F whereas germanium is restricted to 170 F. In addition to tolerating higher ambient temperatures, silicon has greater power handling capacity. The ability of silicon to withstand heat and handle more power also suggests it will vie with selenium as a rectifier material.

How this Valve Solved a Costly Problem ... on Abrasive Fluid, for instance



At Standard Crankshaft & Hydraulic Co., Inc., Charlotte, N. C., with Crane diaphragm valves on regrinding machines, controlling flow of grinding solution to the work.

VALVE SERVICE RATINGS

SUITABILITY: Far better than expected

FEATURES: Pliable neoprene disc insert

MAINTENANCE COST: Zero

SERVICE LIFE: Now 8 times longer than other valves

OPERATING RESULTS: Forced machine down time stopped

AVAILABILITY: Crane catalog item—No. 1610

THE CASE HISTORY

About 3 weeks was the maximum service life of the conventional globe valves formerly on these machines. Their disc and seat were quickly cut out by the abrasive and steel dust that mixed with the re-circulated lubricant. Keeping up with replacements was costly in valves as well as extended machine down time.

Crane 1610 Diaphragm Valves were selected to help if not remedy the situation. They would last longer. Their pliable Neoprene disc insert would absorb the foreign particles that cause leakage and wire-drawing in ordinary valves. And when needed, a disc could be renewed in a few minutes.

But results were far better than expected. The Crane valves installed more than 6 months ago are still in service with no repairs; show no sign of trouble. Naturally, these valves have been put on all grinders.

THE VALVE

Neoprene disc insert seating is but one feature of Crane Packless Diaphragm Valves. Their sealed bonnet isolates working parts from line fluid. Independent disc and diaphragm design reduces diaphragm wear; permits closure on fluid even should diaphragm fail. These valves come in many body and trim materials for corrosive, abrasive, or common services. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
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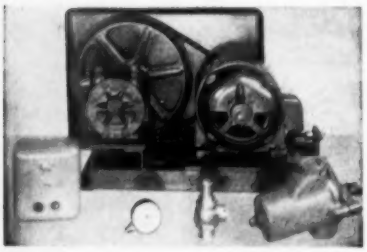
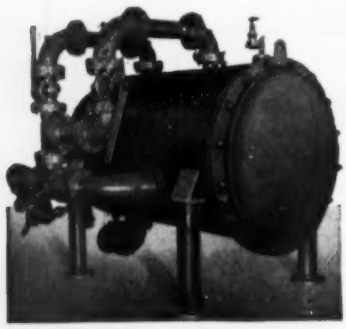
new equipment

and new developments



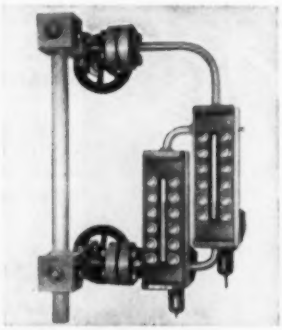
Fuel oil pump sets

G10 York-Shipley, Inc. has developed a viscous liquid pump of the internal gear type for use with non-pump type burners. It is said to be especially adaptable to installations where more than one burner is involved, or where an auxiliary method of oil transportation is required. The unit, designed by the company's Industrial Div. to provide quiet, simple, long-lasting operation, is available as a complete self-contained unit ready for immediate operation when necessary connections to fuel lines and electric service are complete. Capacities are 100, 225, 400, and 700 gph.



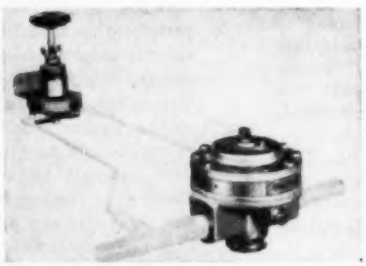
Diatomite filter provides high capacities

G11 To permit safe use of such raw water sources as lakes, rivers, and wells for industrial plant water supply, Sparkler Manufacturing Co. has developed a surface type diatomite filter featuring large capacities. Tests indicate that the unit will completely remove suspended matter, either colloidal or solid, and 80 to 100 percent of bacteria, depending on type of bacteria and grade of diatomite used. The high efficiency is said to reduce amount of chlorination required. Sizes with 25 to 1000 sq ft of filtering space are available with flow capacities of more than 2½ million gallons per day.



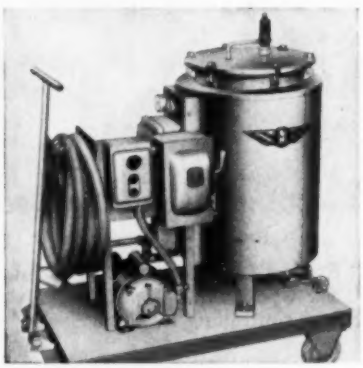
Gage provides accurate boiler level reading

G12 Greater dependability, longer gage life, and more accurate water level reading in high pressure service are listed by the manufacturer, Yarnall-Waring Co., for a separated-design water gage assembly. A lower flanged connection and upper flanged loop connection are used to eliminate stuffing boxes. In addition, the lower flanged connection eliminates the cold water leg, thus resulting in greater accuracy in level reading. On gages for wide range of visibility, greater flexibility is gained by using two independent inserts, and by inter-connecting expansion loops.



Air pressure regulator features remote control

G13 To permit installation of air pressure regulators where they will be the most effective, and still permit control at the most convenient location, C. A. Norgren Co., has developed a pilot-controlled regulator. It is designed for extreme precision in air control over an operating range from 2 to 120 psi, with a capacity of more than 200 cfm. By using regulated air pressure for control, the effect of fluctuating line pressure is said to be minimized. Sizes from ½ to 1 in. are listed in an available data sheet.



Portable unit brings filtration to the machine

G14 To bring filtration to machines which otherwise might not get such protection, the Industrial Filtration Div. of U. S. Hoffman Machinery Corp. has designed a portable cartridge filter. A flexible hose with quick-connecting couplings permits the operator to hook up to a machine's oil supply without interrupting operation. The unit, for hydraulic, quench, or other oils, can be supplied with repackable or throw-away type cartridges, or with either Fuller's earth or cellulose refills. Models with either 30 or 60 gph pump capacity are available. Specifications are tabulated in a data sheet.

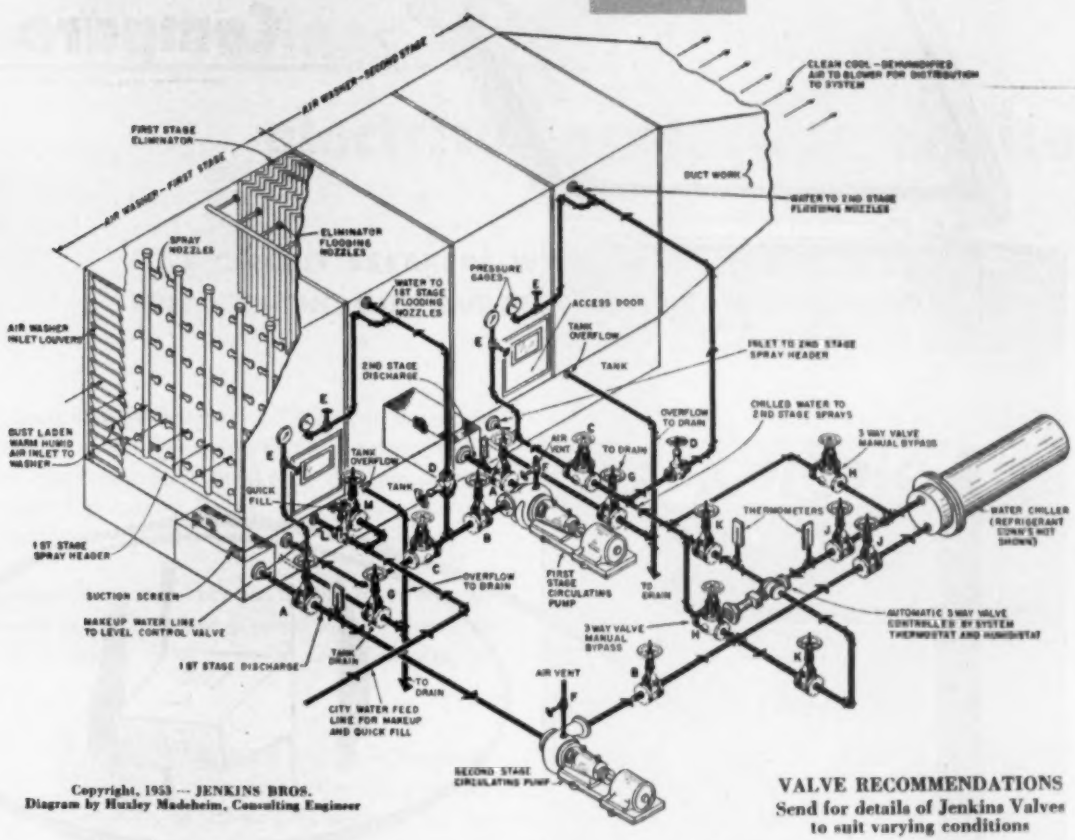
Unit flame-sprays plastic coatings

G15 Compressed air, instead of a vibrator, is used for powder agitation in an improved flame-spray gun and feed-hopper designed by American Agile Corp. In addition to reducing

(Continued on page 12)

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Insert this number on return post card on page 111.

JENKINS PRACTICAL PIPING LAYOUTS 66



Copyright, 1953 — JENKINS BROS.
Diagram by Huxley Madeheim, Consulting Engineer

How to plan PIPING CONNECTIONS FOR AN AIR-WASHER AIR CONDITIONING SYSTEM

The air washer air conditioning system illustrated is a two-stage installation designed to cool, dehumidify and clean air for non-industrial (comfort) purposes.

Water from a chiller, sprayed through second-stage nozzles, picks up heat from the air stream. This water is collected at the bottom of the tank and, still at a temperature below the dew-point of the entering air-stream, is sprayed through the nozzles of the first stage. Here, too, it cools and dehumidifies the air. The water is then pumped back through the chiller and the cycle is repeated.

Excess moisture is removed between stages by a series of baffles which set up abrupt directional changes in the air flow, causing any droplets of water suspended in the air stream to drop out. Separate water spray keeps the baffles wet to collect dust and dirt from the air stream. Final air condition is automatically controlled by proportionate mixing of chilled and return water by means of a three way valve.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 66.

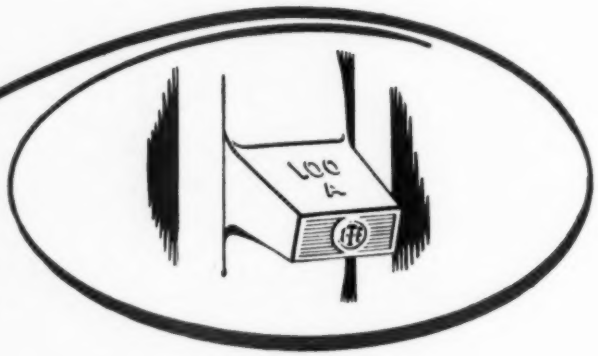
VALVE RECOMMENDATIONS

Send for details of Jenkins Valves to suit varying conditions

Code	Quan.	Jenkins Valve	Services
A	2	Fig. 651-A, I.B.B.M. Gate	Pump Suction Shutoff
B	2	Fig. 651-A, I.B.B.M. Gate	Pump Discharge Shutoff
C	2	Fig. 142, I.B.B.M. Globe	Spray Header Control
D	2	Fig. 956, Bronze Globe	Flooding Nozzle Control
E	4	Fig. 741-G, Bronze Needle	Pressure Gage Control
F	2	Fig. 741-G, Bronze Needle	Pump Air Vents
G	2	Fig. 651-A, I.B.B.M. Gate	Tank Drains
H	2	Fig. 142, I.B.B.M. Globe	3 Way Valve Manual By-Pass
J	2	Fig. 651-A, I.B.B.M. Gate	Water Chiller Shutoff
K	2	Fig. 651-A, I.B.B.M. Gate	3 Way Valve Shutoff
L	2	Fig. 47, Bronze Gate	Feed to Level Control
M	1	Fig. 651-A, I.B.B.M. Gate	Tank Fill Valve for Start up

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
JENKINS
Jenkins Bros.

Compare the



Continuous current rating is permanently engraved on every I-T-E Circuit Breaker. Here's straightforward assurance that the *complete* device (both protective and disconnect features) has been tested as a *unit* under load and approved for the rating specified.

I-T-E

INDIVIDUALLY-ENCLOSED

current ratings before selecting electrical protective devices

I-T-E CIRCUIT BREAKERS WILL SAFELY CARRY THEIR *FULL* CONTINUOUS CURRENT RATING INDEFINITELY

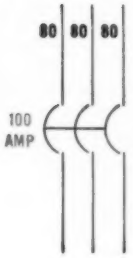
First, bear in mind that every I-T-E Circuit Breaker is tested and rated as a complete *unit*. The rating prominently engraved on the breaker is the true current rating of a protective device, as well as a disconnect device.

Then consider that an enclosed fusible switch is tested and rated as a *switch alone*. If tested as a unit complete with conventional fuses, it would not safely carry its full-rated current continuously. The heat generated before the fuse would blow could be terrific; the switch portion might not stand it.

That's why The National Electrical Manufacturers Association recommend that "fused switches should be selected so as to have a rating at least *50 percent in excess of the load*, for *continuous duty*."

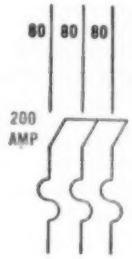
Circuit breakers, however, are taken at "face value."

For example — Suppose you have the problem of providing circuit protection for a feeder supplying a continuous-load lighting panelboard. It happens you have 80 amperes traveling over each wire of a 3-phase feeder system. Selected wire size is rated 100 amperes. (The National Electrical Code says wires cannot be loaded continuously to greater than 80% for safety.)



CIRCUIT BREAKERS

for this job are selected simply. *Just match the circuit breaker rating to the wire size!* Install an enclosed *100-ampere* 3-pole I-T-E circuit breaker for complete protection and safety.



ENCLOSED FUSIBLE SWITCHES

for this job (according to NEMA) should be rated at least 50% in excess of the 80-ampere load. This means a 120 ampere current rating. In this case, it would be necessary to apply the next higher standard size—a *200-ampere* switch!

I-T-E CIRCUIT BREAKER CO. • 19th AND HAMILTON STREETS • PHILADELPHIA 30, PA.

The I-T-E distributor nearest you carries a complete stock of I-T-E individually enclosed circuit breakers.

CIRCUIT BREAKERS

new equipment

(Continued from page 8)

operating noise, compressed air is said to permit closer regulation of raw material feed. Units are designed for flame-spraying coatings of thermoplastic materials on metallic surfaces without the use of solvent carriers. Coatings can be deposited at a rate of approximately 20 lb per hr. Literature is available.

Electroplating power supplies provide operating convenience

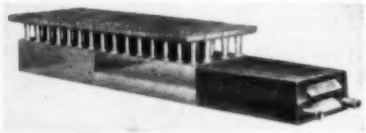
G16 Metallic rectifier power supplies for electroplating and anodizing operations, developed by the Lighting & Rectifier Dept. of General Electric Co., are said to incorporate a number of advances in operating convenience and efficiency. Manually controlled and automatically regulated units are available, as well as special equipment for barrel plating. Operating economy is gained by using a variety of circuits and copper-oxide or selenium rectifier stacks. D-c ratings range from 500 amp at 6 v to 2000 amp at 48 v. Units for barrel plating range from 500 amp at 6 v to 2000 amp at 12 v.

Indicating controller features anticipating action

G18 To provide unvarying, straight line control, Wheelco Instruments Div. of Barber-Colman Co. has designed an indicating controller having anticipating action. Through a resistor network and relay circuit, the Capacitrol Model 221C anticipates temperature changes caused by various heat transfer lags and load requirements. The unit utilizes the Electronic Link, which is said to provide fast, accurate control with no contact between the measuring and control system. Measuring accuracy is provided by a high resistance galvanometer movement. Interchangeable voltage plugs are provided for 115 and 230 v a-c.

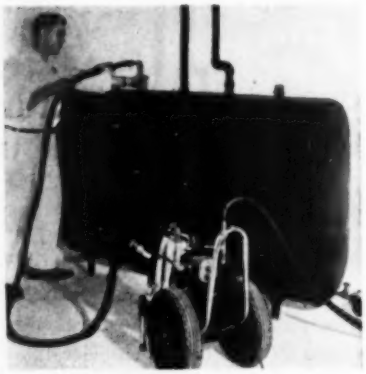
TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.



Commercial gas burner features simplified installation

G19 To supplement its gas-fired equipment, Petro has introduced a series of commercial gas burners in sizes ranging from 450,000 to 11,520,000 Btu input. This multiple section upshot burner is said to be easily installed through the ash pit door. Numerous possible combinations of burner heads permit the most effective use of the firebox area. Individual venturi mixing tubes for each burner head assure uniform mixture to all parts of the burning area, and adjustment is provided for various types of fuel gas. Burner head sections may be controlled by either manual or automatic valves.



Vacuum unit cleans storage tanks

G20 A new and unusual application for rotary pumps has recently been devised by Visa-Clean Corp. The manufacturer utilizes a Worthington 2GA rotary pump as the heart of a new Visa-Clean machine, designed for vacuumatic liquid-storage tank cleaning. The unit removes sludge, dirt, water, and other impurities from liquid storage tanks, and can be applied to almost any type tank and almost all liquids.

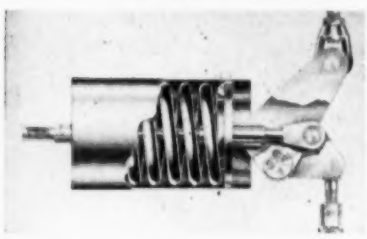
Back-up rings prevent extrusion of O-Rings

G21 Back-up rings, spirally machined of tetrafluoroethylene, have been designed by The Garlock Packing Co. to prevent extrusion of O-rings. The Teflon rings have a high impact strength at temperatures from -100 to 500 F. In addition, they are non-

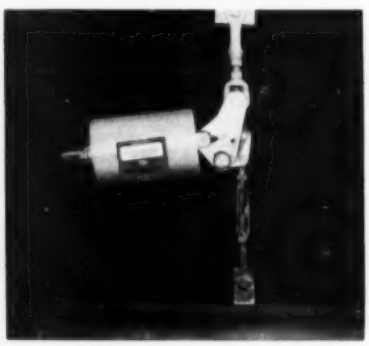
(Continued on page 16)

Hanger provides accurate support for high temperature piping systems

G17 Accurate, efficient support for high temperature piping systems is provided by the Navco Counterpoise pipe hanger, designed by National Valve & Manufacturing Co.

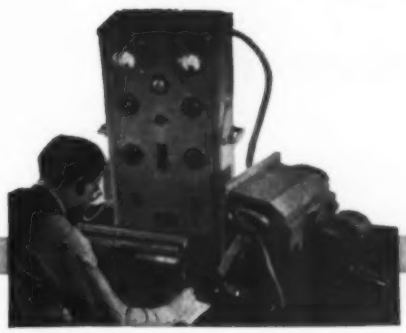


It is a spring-actuated counterbalance which transforms the varying force of the spring in an accurate mathematical ratio to produce a constant load supporting effort throughout the entire range of pipe expansion and contraction. To permit flexibility of installation and save space in congested areas, all principal load-carrying parts are concentrated at one end. Construction of units ranging from 200 to 16,000 lb load capacity, and expansion travels up to 12 in., is described in a 12-page bulletin.



SMALL PLANTS, TOO!

CAN PROFITABLY USE THE *Nalco* SYSTEM



X-Ray equipment, used in the Nalco Laboratories as an aid toward providing positive water treatment results.

● *Water treatment service for small plants is an important part of Nalco's business.*

This indicates two things:

Small plants find Nalco Service Agreements a profitable investment . . . And

Nalco facilities and services are geared to handle — efficiently and economically — the needs of *any* plant, regardless of its size or the volume of water treatment chemicals used.

If your plant is a small one, you can get the same security from water treatment difficulties as many of the world's largest steam generating stations have with Nalco Service Agreements — and at a cost entirely in line with the size of *your* plant and your problems. Write today for complete details, or call your Nalco Representative.

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

THE *Nalco* SYSTEM...Serving Industry through Practical Applied Science

"We Saved Money and got better Protection for TWO Customers by switching to FUSETRON *dual-element* FUSES"

"Fusetron Fuses made it possible to use smaller size switch."

"Early this year I had the opportunity to lay out a wiring job for the Nehi Bottling Works at Boise, Idaho.

"After figuring the job with ordinary fuses it was found necessary to use a 400 ampere 250 volt main switch to carry the load.

"The proprietor of the bottling works felt that the cost was too great. I, therefore, re-figured the job with Fusetron fuses and I found that I could use a 200 ampere 250 volt switch which besides being less expensive would result in better protection.

"Needless to say the proprietor was happier with the lower cost and I received the electrical contract."

Start Saving

FUSETRON dual-element FUSES do more than protect against short-circuits —they give 10 POINT PROTECTION

1 Protect against short-circuits.*

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money—permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December, 1947.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

One needless shutdown . . . one lost motor . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse **now!**

"Heating in a main switch was causing fuses to blow until a Wholesaler's Salesman showed us how to cure the trouble with FUSETRON dual-element Fuses."

"During 1948 I was confronted with a bad heating problem in a 600 ampere 250 volt switch at Falk's Department Store, Boise, Idaho.

"When we checked the load on the switch we found that only 380 amperes were flowing. Even with this load the ordinary fuses used would melt and open every 30 to 90 days.

"The result of these fuse blows was confusion and annoyance to both customers and employees.

"At the suggestion of a local wholesaler's salesman 600 ampere 250 volt Fusetron dual-element Fuses were installed.

"The heating in the switch stopped immediately and we have not had that type of trouble since."

R. M. Alloway
Alloway Electric Co.,
Boise, Idaho.

FOR INFORMATION, MAIL THIS COUPON TODAY . .

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 753

with Fusetron Fuses

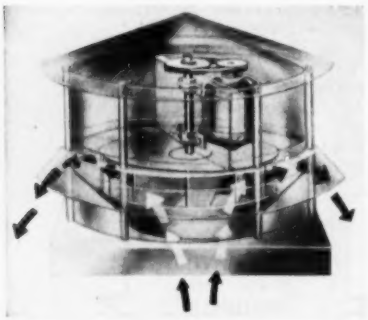
new equipment

(Continued from page 12)

corrosive, non-adhering, non-fraying, inert to most chemicals, and self-lubricating. They are made for all O-ring sizes to AN drawings 6227 and 6230.

Mercury lamp illuminates water level meniscus

G22 Brilliant illumination of the water level meniscus is provided by a boiler water gage illuminator developed by Reliance Gauge Column Co. The unit consists of an efficient spot beam mercury lamp enclosed in a housing which attaches readily to the water gage insert. It is especially recommended for conditions where gages are 40 ft or more from the operating level, or where murky atmosphere or light from other sources impairs visibility. The unit is described in a data sheet.



Power exhauster develops high static pressure

G23 Belt-driven, power roof exhausters for application in ventilation problems demanding high static pressure and large volumes of air have been developed by The Gallaher Co. Units will develop up to 4 in. static pressure and up to 65,000 cfm. High performance is said to be the result of a patented scroll effect developed for centrifugal exhausters. The unit features a weatherproof umbrella-type outlet, and a balanced, backwardly-curved, centrifugal fan wheel.

Bus runs feature high ratings

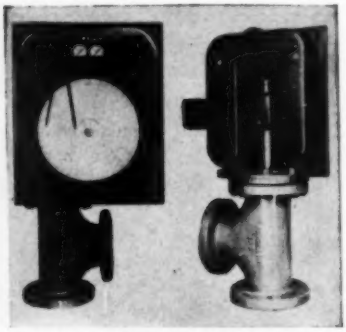
G24 Metal-enclosed, isolated-phase bus runs, rated up to 8000 amp, 14.4 kv, that can be shipped in three-phase packages in lengths up to 16 ft, have been announced by the Switchgear Dept. of General Electric Co. Increased lengths and ratings are made possible by the use of aluminum conductors, instead of the heavier copper conductors formerly used. Electrical joints between aluminum conductor sections are silver surfaced to provide permanent, low-resistance joints.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.

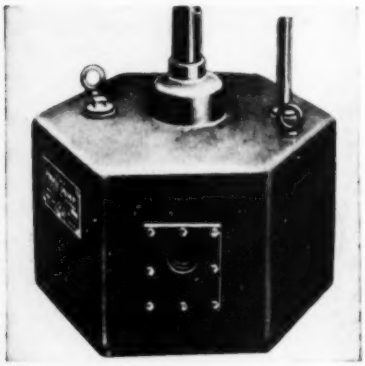
Instrument reduces electric equipment failures

G25 To cut down on electrical equipment and power failures, and reduce the threat of electrical fires, Multi-Amp Corp. has developed a testing instrument known as the Industrial Multi-Amp. Described as a portable, high current test unit, it permits checking circuit breakers, overload relays, and other current actuated devices before they are installed, when they are installed, and periodically after they are in service. Input is 0 to 10 amp for 110 v, 60 c supply. Applications are discussed in a 12-page bulletin.



Instrument incorporates pneumatic transmission

G26 Penn Industrial Instrument Corp. reports the use of a pneumatic transmission in its Linameter variable area type flow meter. The unit is fundamentally linear, and air output signal varies directly with rate of flow. It is mounted directly in the pipeline, and is suitable for measuring flow rates of liquids, vapors, or gases from 0.3 to 3 gpm minimum to 120 to 1200 gpm maximum. The design eliminates stuffing boxes and pressure bearings. It is particularly suitable for measuring fluid flow rates which cannot be conveniently handled by differential pressure type instruments, for hazardous locations, and as a flow transmitter for use with pneumatic receiver recorders, controllers, and indicators. Construction is described in a catalog.



Pneumatic ejector handles problem materials

G27 For pumping problem materials in low volumes, Yeomans Brothers Co. has developed a simplified pneumatic ejector. Compactness and the use of only one moving part, a ball inlet valve, makes the unit simple to install and to operate. Known as Pneu-Pump, it will handle materials such as abrasive liquids, acids, alkalies, molten metals, molten salts, syrups, slurries, and tar. It is operated from existing compressed air supply, from

(Continued on page 20)

Modern power plant practice demands a water conditioning program that produces only the ultimate in trouble-free and efficient boiler operation.

External softening and the use of conventional inorganic treatments are recognized requisites. However, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

Take the case, for example, of a large electrical manufacturer, who called in Betz 14 years ago to treat its new power plant. This plant operates at 900 pounds pressure with 50% make-up polluted river water. Betz recommended the use of organic agents to supplement the external softening and inorganic treatment.

Here are the results from the record: In the entire 14 years operation of these boilers, they have never been turbined or acid cleaned and no difficulties from feedwater conditions have occurred! What's more, excellent steam purity is produced and turbine blading is completely clean.

This plant could easily be your plant—operating efficiently, free from frequent boiler outages through the effective use of Betz *Specialized* Water Conditioning Service. Why not call on Betz today for an interesting discussion of your water problems? There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

Send today for Betz Technical Paper No. 98, "Boiler Scale—Its Formation and Prevention." It's free.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Ready FOR ANY FUEL JOB

NAME OF COAL	CHARACTER	MINE
Sonman	Central Pennsylvania Low Volatile	Sonman
Indian Creek	Central Pennsylvania Medium Volatile	Melcroft
Federal	Northern West Virginia	Federal #1
Bergoo		Bergoo #2
		Bergoo #4
		Bergoo #6
Bolair		Bolair
Beckley	Southern West Virginia Low Volatile	Eccles #5
Sewell		Eccles #6
New River		Helen #9
		Stotesbury #8
		Stotesbury #11
Pocahontas		Keystone
		Maitland
Eagle	Southern West Virginia and Eastern Kentucky High Volatile	Beards Fork
		Page
		Kopperston #1
Nos Gas		Kopperston #2
Wharton		Wharton #1
		Wharton #2
Weeksbury		Weeksbury

There's never any need for compromising on the fuel properties you require for your particular combustion job, when you use Beacon Coal. You'll find, in this comprehensive line, a fuel that's exactly suited to each application: domestic hand and stoker fired; commercial hand or stoker fired; general industrial; electric utilities; railroad; steamship bunker; coke and gas plants; and special uses. Mine locations and shipping facilities, as shown on the chart, permit the most advantageous distribution. And finally, the conveniently located sales offices bring the able services of Beacon representatives within easy reach.

Want a copy of this chart for your fuel file?

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If you'd like one of these ready-reference charts for file . . . just drop a line to the nearest office.

EASTERN

PITTSBURGH • BOSTON

For New England

This convenient Reference Chart shows why!

SEAM	COUNTY & STATE	RAILROAD	DIS-TRICT	SIZES MADE	DAILY PROD. TONS	NAME OF COAL
"E"	Cambria (Pa.)	Penna.	1	Egg; Stoker; M/R; N&S; Slack	2500	Sc[illegible]an
"B" or Miller	Fayette (Pa.)	B & O	1	M/R; N&S; Slack	1200	Indi[illegible]Creek
Pittsburgh	Marion (W. Va.)	Monongahela; B&O	3	Lump; Egg; Nut; Stoker; M/R; N&S; Slack	10,000	F[illegible]ral
Sewell	Webster (W. Va.)	Western Maryland	3	M/R	1500	
Sewell	Webster (W. Va.)	Western Maryland	3	Lump; Egg; Nut; Jr. Egg; M/R; N&S	1600	B[illegible]oo
Sewell	Webster (W. Va.)	B & O	3	M/R	1000	
Fire Creek	Webster (W. Va.)	B & O	3	Egg; Nut; M/R; N&S	2000	B[illegible]ir
Beckley	Raleigh (W. Va.)	C&O; Virginian	7	Egg; Stove; Nut; N&S; Slack	2500	Be[illegible]ey
Sewell	Raleigh (W. Va.)	C&O; Virginian	7	M/R; N&S; Slack	1000	S[illegible]ell
Pocahontas #3	Raleigh (W. Va.)	C&O; Virginian	7	Stove; Nut; N&S; Slack	2500	
Pocahontas #4	Raleigh (W. Va.)	C&O; Virginian	7	Stoker; M/R; Slack	2000	Nev[illegible]iver
Pocahontas #4	Raleigh (W. Va.)	Virginian	7	M/R; Slack	1800	
Pocahontas #3	McDowell (W. Va.)	N & W	7	Egg; Stove; Nut; Stoker; M/R; N&S; Slack	5000	Poc[illegible]ntas
Pocahontas #4	McDowell (W. Va.)	N & W	7	Stoker; M/R; Slack	1500	
Eagle	Fayette (W. Va.)	Virginian	7	M/R; N&S	1500	
Eagle	Fayette (W. Va.)	Virginian	7	M/R; N&S	1000	E[illegible]le
Eagle	Wyoming (W. Va.)	Virginian	8	M/R; N&S; Slack	3500	
Campbells Creek	Wyoming (W. Va.)	Virginian	8	M/R; N&S; Slack	4000	No. [illegible]Gas
Hernshaw	Boone (W. Va.)	C & O	8	Lump; Egg; M/R; N&S	3500	W[illegible]ton
Hernshaw	Boone (W. Va.)	C & O	8	M/R; N&S	3000	
Elkhorn #3	Floyd (Ky.)	C & O	8	Block; Egg; M/R; N&S; Slack	1000	We[illegible]bury

GAS AND FUEL ASSOCIATES

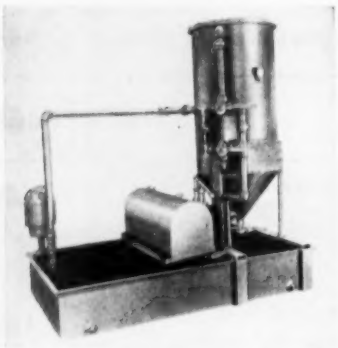
CHICAGO · CLEVELAND · DETROIT · NEW YORK · NORFOLK · PHILADELPHIA · SYRACUSE

New England Coal & Coke Company — For Export: Castner, Curran & Bullitt, Inc.

new equipment

(Continued from page 16)

a separate compressor, or from a steam supply. Construction is described in a 4-page folder.

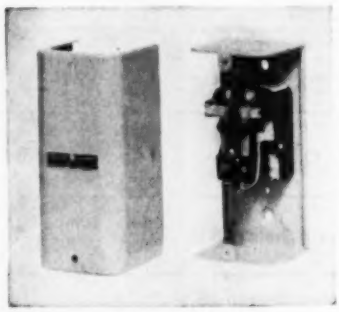


Coolant clarifier features high filtering capacity

G28 To remove chips, abrasives, dirt, and other solid contaminants from both water-based and mineral oil coolants, Honan-Crane Corp. has developed the Houdaille J type coolant clarifier. The compact, multiple filter-tube unit features over 16,000 sq in of filtering area. For continuous or intermittent operation, it may be applied to individual machine tools or small central systems. Clarification is accomplished by passing liquid through multiple filtering tubes extended vertically within the unit. Self-cleaning tubes do not require manual cleaning or maintenance.

Conduit features improved characteristics

G29 Easier bending and wire-pulling characteristics, and improved corrosion resistance, are listed by General Electric's Construction Materials Div. for G-E White rigid steel conduit. The improved characteristics are said to result from a metallizing process of zinc coating, which does not harden the conduit or form brittle zinc-iron alloy. In addition, an anti-friction inside coating has been added to make wire pulling easy, and to provide interior protection against corrosion.



Relay provides longer life

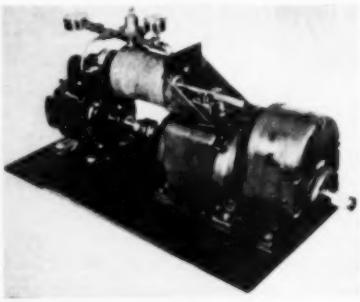
G31 Longer life and greater flexibility are provided by a line of general-purpose relays announced by General Electric Company's Control Dept. Operating life has been extended by use of a braided shunt, and repositioning of the shunt to reduce tension and wear. Standardized open-form relays with conversion kits provide greater utility and permit reduction in inventory. Units are rated from 6 to 300 v, 10 amp continuous contact rating, for 25, 50, and 60 c a-c, or for d-c. Suggested applications include small a-c motors having sufficient overload protection, electronic equipment, and air conditioners.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.

Unit proportions combustion air and gas

G32 To meet the need for an inexpensive device to accurately proportion large quantities of low pressure gas and air used for combustion, The North American Mfg. Co. has developed a relay control, air operated, cross-connected governor. Known as the series 630 Proportioner, it may be installed in either gas or air lines of any standard pipe size from 4 through 16 in. Capacities range from 24,100 to 385,000 cfh. Construction is described in a bulletin.



Variable speed drive features linear response

G33 Exact changes in speed, according to a signal from a sensing device, is provided by a Conoflow pneumatic control designed for use with

(Continued on page 24)

Attachment for crane truck proves to be practical sky-hook

G30 One or two men can work safely and quickly at otherwise inaccessible overhead jobs with an ingenious attachment developed by Yale Materials Handling Div. of The Yale & Towne Manufacturing Co.

Basically, the Tey Hydro Sky-Lift is a gigantic articulated arm which can lift 500 lb from the floor and hold it at any point within the upper half of a sphere with a 26 ft radius, measured from the pivot point of the boom attachment. From the truck which serves as its solid base, it can stretch to a working height 34 ft. from the ground and provide a stable platform in a complete horizontal circle.

At the end of the boom are one or two crow's nests, each large enough to permit a man to work comfortably. One nest is fitted with a set of controls, and is hydraulically operated to ensure positive and smooth action at any degree and in all directions.

The unit is mounted on a heavy duty chassis equipped with specially designed hydraulic over-the-side outriggers for stability even when the boom is fully extended.

can be just as important to you!

Your life line . . . the single thing that keeps your plant operating at a profit . . . is efficient and continuous production. Your profits, employee morale, plant-community relations . . . all can be seriously threatened by inadequate dust or fume control.

Air is the all-important tool in dust and fume control. KIRK & BLUM skill and experience in putting to work "clean air—the *invisible* tool" is demonstrated in thousands of installations.

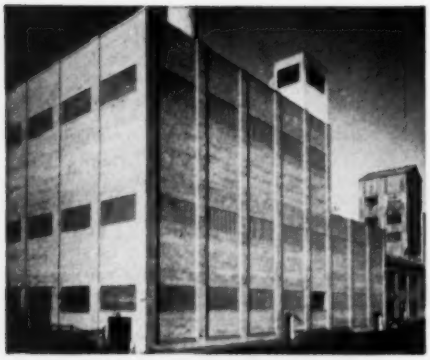
KIRK & BLUM, for over 45 years, have been specialists in designing, fabricating and installing dust and fume control systems. From the time engineers arrive to consult, to the moment skilled erectors leave . . . your work is in the hands of one experienced, reliable organization.

KIRK & BLUM engineers will confer with you on any dust or fume problem you may have. Write The Kirk & Blum Mfg. Co., 3174 Forrer Street, Cincinnati 9, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

DUST AND FUME CONTROL



THE AMALGAMATED SUGAR COMPANY, Rupert, Idaho
One 150,000 pound Detroit RotoGrate Stoker

THE AMALGAMATED SUGAR COMPANY, Nyssa, Oregon
Three 90,000 pound Detroit RotoGrate Stokers

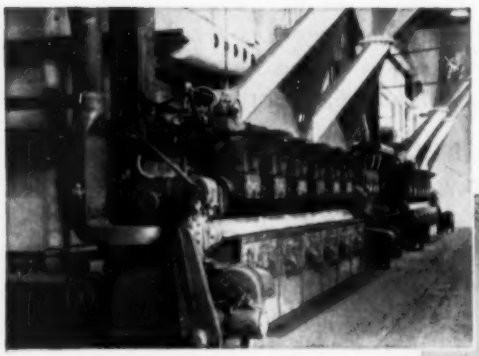
Detroit Stokers Burn Coal EFFICIENTLY in Many Food Product Plants

Repeat order customers are the best evidence of satisfactory performance of Detroit RotoGrate Stokers and Detroit RotoStokers—spreader stokers that burn a portion of the fuel in suspension—the balance on grates of special design.

They Provide These Features You Need In A Stoker:

- Burn any Bituminous Coal or Lignite without special preparation.
- Increase capacities due to higher burning rates.
- Provide exceptional fuel economy.
- Are exceedingly responsive to fluctuating loads.
- Operate with low auxiliary power.
- Coal feed and air supply are automatically controlled.
- Operate with preheated air if desired.
- Availability high . . . Maintenance low.

Do you need more steam? If so, investigate and order your Detroit Stokers now. Write for Bulletin—No Obligation

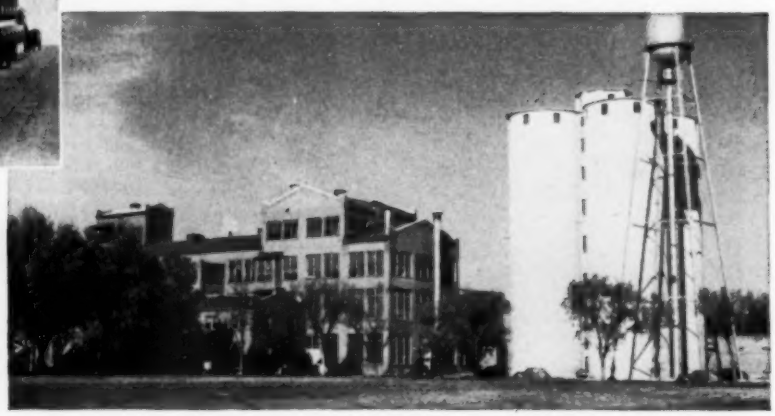


GREAT WESTERN SUGAR COMPANY,
Fort Morgan, Colorado
Two 102,500 pound
Detroit RotoGrate Stokers

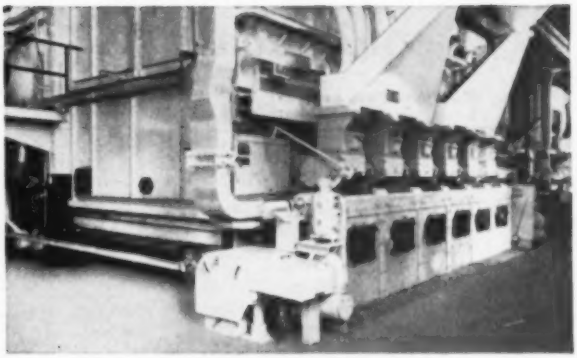
DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

District offices in Principal Cities • Works in Monroe, Mich.



UTAH IDAHO SUGAR COMPANY, Garland, Utah
Two 100,000 pound Detroit RotoGrate Stokers



GREAT WESTERN SUGAR COMPANY, Longmont, Colorado
Two 150,000 pound Detroit RotoGrate Stokers

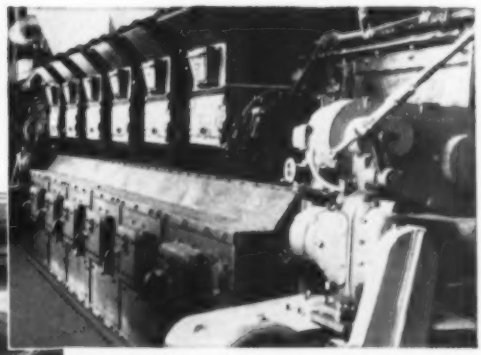
It's What USERS Say That COUNTS . . . FOOD PLANTS LIKE DETROIT STOKERS

★Repeat Order Plants

★Amalgamated Sugar Company
★American Crystal Sugar Company
★Armour & Company
★Borden Company
California Packing Corporation
Campbell Soup Company
The Capital City Products Company
★Central Soya Company, Inc.
W. N. Clark Company
★Clinton Industries, Inc.
★Cranberry Canners, Inc.
Cudahy Brothers Company
DuQuoin Packing Company
J. A. Folger Company
Forbes Brothers—Central Mills Inc.
★General Foods Corporation
General Mills, Inc.
★Great Lakes Sugar Company
★Great Western Sugar Company
Gunnison Sugar, Inc.
Hawaiian Commercial & Sugar Co. Ltd.
★Illinois Meat Company
★International Salt Company
★The Keever Starch Company
Lake Shore Sugar Company
★Libby, McNeill & Libby
Manistee Salt Works
★Oscar Mayer & Company
Menominee Sugar Company
★Michigan Sugar Company
Monitor Sugar Company
Morton Salt Company
National Fruit Products Company
National Oats Company
★National Starch Products, Inc.
National Sugar Manufacturing Company
★G. M. Peet Packing Company
★Planters Nut & Chocolate Company
Quaker Oats Company
★Ralston Purina Company
★The Rath Packing Company
Russell Miller Milling Company
J. R. Short Milling Company
★Stokely Foods, Inc.
Sugardale Provision Company
★G. S. Suppiger Company
★Swift & Company
Tobin Packing Company, Inc.
★Utah-Idaho Sugar Company
Vincennes Packing Company
Western Grocer Company
★Wilson & Company, Inc.

There is a type and size of Detroit Stoker for every Industrial need.

DETROIT SINCE 1898.. STOKERS

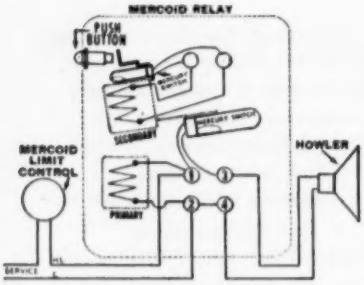


AMERICAN CRYSTAL SUGAR COMPANY,
Moorhead, Minnesota
Two 90,000 pound Detroit
RotoGrate Stokers

new equipment

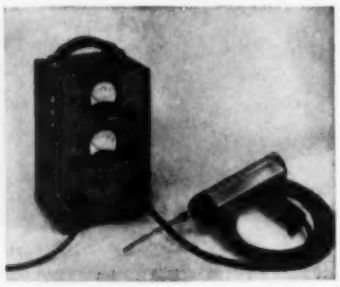
(Continued from page 20)

variable speed transmissions manufactured by Graham Transmissions, Inc. The sensing element may be actuated by flow rate, pressure, pH, temperature, humidity, liquid level, or other variables. Linearity of response is said to make the unit particularly desirable for continuous processes where operating conditions vary continuously, but where rapid and accurate control is essential. The unit is available with or without built-in motor. The illustration shows an arrangement worked out by % Proportioneers, Inc. %, using a separate coupled motor with a ¾ hp drive.



Relay automatically re-establishes alarm circuit

G34 To permit operators to manually interrupt an audible alarm, and to provide automatic re-establishing of the alarm circuit as soon as the condition requiring the alarm has been corrected, The Mercoid Co. has developed a push button relay. In actual use, the operator stops the alarm manually. When the condition which actuated the alarm is corrected, the alarm is automatically reset. The unit is available for 115, 230, or 440 v a-c or d-c supply. Alarm circuit is rated 10 amp at 115 v, 5 amp at 230 v, or 3 amp at 440 v.



Unit detects leaks in closed systems

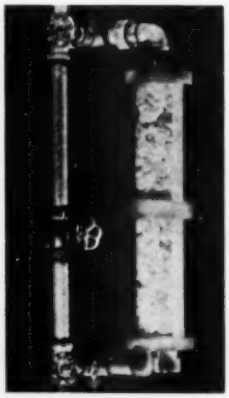
G35 To permit easier detection of leaks in closed systems, General Electric Company's Meter and Instrument Dept. has redesigned its portable, halogen-sensitive leak detector. The unit, known as type H-1, can detect a leak so small that only 1/100 oz of gas will pass through the opening in a year. It is used for detecting leaks in refrigerator and air conditioning systems, tanks, boilers, piping, and similar equipment. In addition to indicating leaks by means of a dial and earphone attachments, a loud speaker has been built into the control unit for audible indication.

Thermostat controls fan

G36 Fuel savings up to 10 percent are possible as a result of a thermostatically controlled fan drive designed by Schwitzer-Cummins Co. for use on heavy duty engines. When cooling is not required, the thermostat automatically disengages the fan.

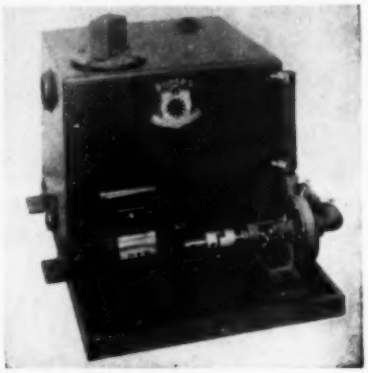
TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.



Crystals prevent rust formation

G37 Rusty water, caused by rust in tanks and pipes, is inexpensively eliminated by Aqua-Clear crystals and feeder, according to the manufacturer, Sudbury Laboratory. A transparent, microscopically thin protective film is said to be formed on inner surfaces of tanks and pipes, thus preventing water from coming into actual contact with the metal. In addition to stopping rust it is said to stop electrolysis and galvanic action. The only operating cost is the occasional replacement of crystals, which is reported to average approximately 3¢ per thousand gallons of water treated.



Condensate pump eliminates pit

G38 Walter H. Eagan Co., Inc. has designed a condensate pump which does not require a pit, even though return pipes are as low as a foot above the floor. The unit handles 8000 sq ft of radiation at 20 psi. It consists of a bronze centrifugal pump and flexible couplings which isolate the pump from the motor and piping, thus preventing pipe cramp, misalignment, wear, and noise. Power is supplied by a ¼ hp, 115 v, single phase motor. The unit is said to feature a large capacity safety factor, providing for at least a 1 to 3 on-off operating cycle with tight traps.

Electronic wattmeter provides accurate measurements

G39 Unusual convenience and accuracy of measurements is provided by the Model 110 electronic wattmeter, according to the manufacturer, Keithley Instruments. The unit, basically an amplifier driving the potential coil of a dynamometer wattmeter, features a range from .3 to 300 w on six scales, with accessory shunts extending the range to 9000 w. Frequency response from 20 to 3000 cps permits measurements at all power frequencies. Uses include transformer core loss tests, and measuring power to fuses, fusible links, and fluorescent lamps and ballasts.

—End

COCHRANE WATER CONDITIONING
STARTS WHERE NATURE STOPS

AT PENNSYLVANIA ELECTRIC CO.
IT'S A COCHRANE DEMINERALIZER

Cochrane Demineralizer Installation at Pennsylvania Electric Co., Erie, Pa.— Gilbert Associates, Inc., Engineers, Reading, Pa.

• To supply high quality water for boilers operating at 1250 P.S.I.G. the Pennsylvania Electric Company installed a Cochrane Automatic Demineralizer in their Erie, Pa. Power Station. Designed for silica removal, this unit handles 400 GPM in preparing make-up for the boilers.

Demineralization is one of many "water problems" Cochrane's engineers solve every day. Water softening, dealkalization, and deaeration are others—all complex—all requiring expert and specialized knowledge. Whether for process or boiler feed water Cochrane can supply the answer to your particular problem, backed by 90 years' experience in solving industrial water conditioning problems. You'll be sure of unbiased recommendations because Cochrane designs and builds all types of water conditioning equipment.

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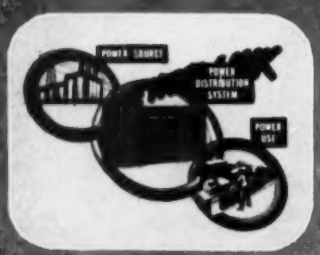
a new G-E sound color slidefilm

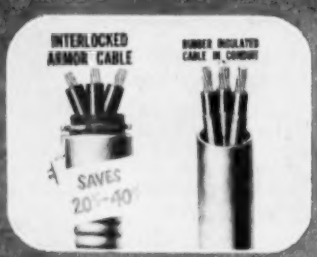


MODERN POWER SYSTEM *provides*
GREATER RELIABILITY
GREATER FLEXIBILITY
HIGH DEGREE OF SAFETY

12 MONEY-SAVING IDEAS *for* MODERN INDUSTRIAL POWER SYSTEMS

New sound color slidefilm . . shows how modern practices keep costs down and production up

1. Use load-center distribution



6. Use Interlocked Armor Cable

. . . and Plug-in Busway

7. Use d-c load-center systems

8. Apply Capacitors

20 minutes of modern ideas can save you thousands of plant electrical dollars

- ASSURED POWER CONTINUITY
- REDUCED INSTALLATION AND OPERATING COSTS
- FAST, EASY SYSTEM PLANNING
- PROTECTION FOR PERSONNEL AND EQUIPMENT

This new film gives a summary of the most advanced thinking in the field of plant distribution engineering in the last 10 years.

If you haven't made any changes in your plant electrical system during this period, you are probably losing thousands of power dollars each year. If you are planning expansion or modernization, then this film is even more important.

The 20-minute film, together with a 28-page Industrial Power Distribution Idea Book, will bring you up to date on the most recent engineering developments in power distribution. The film examines and evaluates a dozen ideas in this field—ideas that will help you *plan* your system from the beginning . . . *reduce* distribution costs . . . *maintain* power continuity . . . and *safeguard* both personnel and equipment.

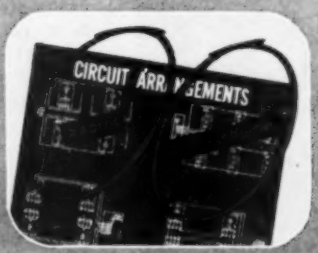
To follow-through, you can call on your consulting engineer, your utility's industrial power sales engineer, and General Electric's sales engineer. They will help you plan and install your system—from metal-clad switchgear to load-center unit substations.

YOU CAN ARRANGE A SHOWING AT YOUR PLANT of "The Vital Link" through your nearest G-E apparatus sales representative. General Electric Co., Schenectady 5, New York. 881-2

You can put your confidence in—

GENERAL ELECTRIC

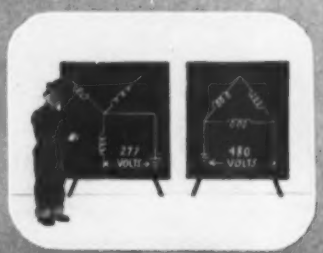
2. Choose economical substation size



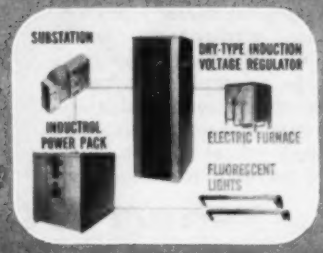
3. Select simple circuit arrangements

480-VOLT SYSTEM
SAVES 35%
compared with a
240-VOLT SYSTEM

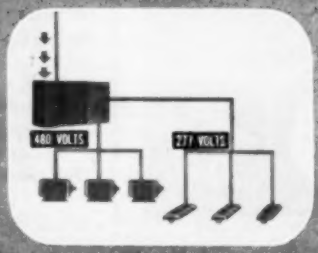
4. Select high primary and secondary voltages



5. Use system neutral grounding



9. Reduce voltage spread



10. Use high-voltage fluorescent lighting

AVAILABLE SHORT-CIRCUIT CURRENT
(SECONDARY RATING 480 VOLTS, 3-PHASE)

Available Primary 3-Phase Short Circuit KVA	Substation KVA Rating			
	150	500	750	1500
	Low Voltage Short-Circuit Currents 1000 Amps			
50,000	5.6	15.5	20.8	35.6
150,000	5.8	17.1	23.3	43.8
500,000	5.9	17.8	24.5	47.9
UNLIMITED	5.9	18.1	25.0	50.1

11. Be sure of your "I.C."

Count on

the CONSULTING ENGINEER
the ELECTRIC UTILITY
the ELECTRICAL MANUFACTURER

12. Take advantage of consulting services

CONSIDER

STEAM TURBINES

AS MOTIVE POWER

TO OPERATE
COMPRESSORS
PUMPS
FANS
BLOWERS
WINCHES
GENERATORS
MIXERS
AND
SIMILAR
EQUIPMENT

HERE ARE THE ADVANTAGES:

VERSATILE DEPENDABLE: Wing Steam Turbines give an infinite range of speeds, easily controlled by throttling. Always on the job, you are completely *independent* of any electric power failure.

ECONOMICAL: Wing Steam Turbines cost little or nothing to operate where their oil-free exhaust steam can be used in process operations—or in space heating. The Turbine acts as a reducing valve . . . its exhaust steam has been reduced down to the pressures used in heating and cooking operations.

NO SPARKS: Wing Steam Turbines are especially desirable for operations involving explosive gases and flammable materials, where sparks could be dangerous.

SMOOTH ACCELERATION OR DECELERATION: Wing Turbines can be smoothly accelerated or slowed down to meet the needs of the process, fan, pump or other driven apparatus.

OPERATING RANGES:

Horsepowers to	150 b.h.p.
Temperatures to	750°F.
Pressures to	600 p.s.i.
Back Pressures to	50 lb.
Speeds to	4000 r.p.m.

WING Steam Turbines have been serving industry for over a half-century. They are known for their rugged construction, trouble-free operation, and long life.

Write us today about further information. And ask for Bulletin SW-1a.

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L. J. Wing Mfg. Co.

139 Vreeland Mills Road

Linden, New Jersey

Factories: Linden, N.J. and Montreal, Can.

A READER COMMENTS . . .

I & P April Article

Sir:

The April, 1953 issue of your publication, INDUSTRY AND POWER, carried an article titled, "Selecting Taps on Power Transformers," by Mr. Frank E. Reeves, Electrical Engineer. This article outlined a graphical method of showing system voltages and voltage drops. The method outlined is very good and should be highly recommended. My purpose in writing this letter is to present additional information to assist anyone attempting to select the voltage ratings of power transformers.

The Electrical Standards committee of the American Standards Association in March, 1952, published a new standard, C-57.12a titled, *Proposed American Standard for Transformers.* This standard covers the power transformers which are in the category referred to in the article as the standardized design or "repetitive manufacture" types. These standards state that the voltage taps are to be equally spaced; two above and two below rated voltage. This means that according to the new standard it is not possible to obtain other tap arrangements as suggested in the article and still receive the benefits of standardized or "repetitive manufacture" designs.

The article also included the statement, "Tap ratings in no way limit the voltage which may be applied to the taps, within reasonable limits." This statement is subject to some interpretation, and I believe the limits should be stated. These limits as stated in the ASA Standard C-57.12, dated 1949, are:

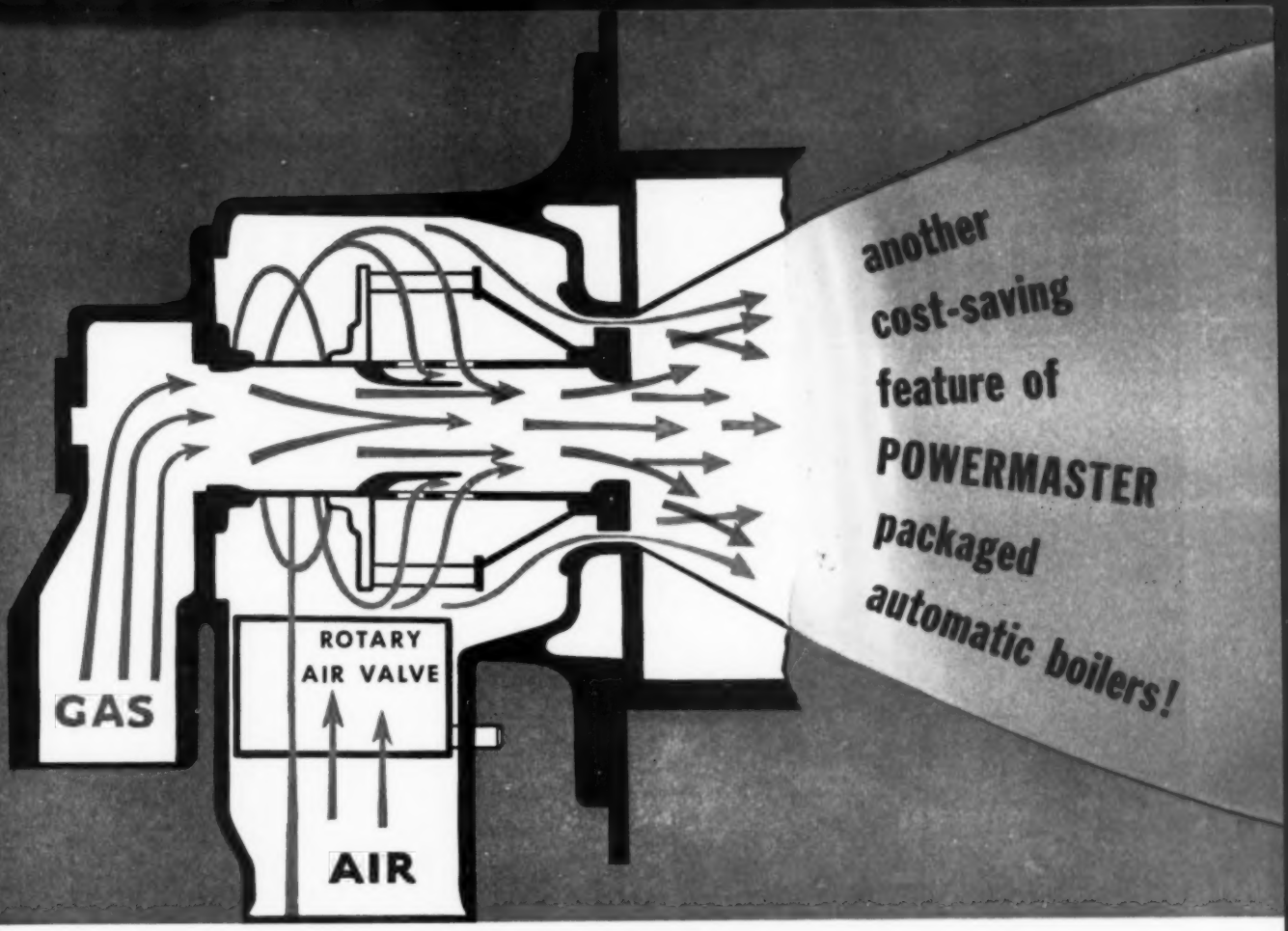
"1. Transformers shall be capable of (a) delivering rated output in kva at 5 percent above rated output voltage, and (b) operating at 10 percent above rated output voltage at no load, without exceeding the guaranteed temperature rise.

"2. Unless otherwise specified, the first requirement applies to load power factors of 80 percent or higher.

"3. The foregoing requirements apply to the rated voltage and rated kva for any tap."

One of the assumptions used in the article is that the load voltage be permitted to vary from minus 5 percent under full load conditions to plus 5 percent under light load conditions and all of the examples are based on generator voltage ratings, that is, 100 percent is used as representing the generator rated voltage in each case. This method overlooks one important

(Continued on page 33)



The *VORIFLOW*® Gas Burner

Keeps fuel costs DOWN ...boiler efficiency UP

You can always depend on getting highly efficient and economical gas-firing with a Powermaster packaged automatic boiler because the Powermaster VORIFLOW gas burner gives you these operating advantages:

1. Infinitely Variable Combustion Modulation

Fully automatic control of fuel and combustion air responds instantly to load demands ranging from 20% to 100% of firing capacity—*with full efficiency!* There's no fuel-wasting combustion with the VORIFLOW gas burner because properly proportioned fuel and air are thoroughly pre-mixed to insure immediate ignition and complete burning upon entering the combustion chamber. All components of this unique burner are carefully sized for the Btu content of the gas supply and the heat requirements of the boiler.

2. High Efficiency Design and Construction

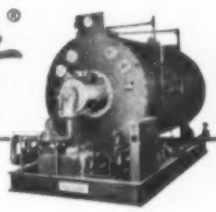
In the VORIFLOW burner, gas flows through the central gas nozzle from the gas plenum. Combustion air from the blower enters the air plenum, proportioned automatically by the motor operated rotary air valve. Primary pre-mixing air is captured by a stationary compressor wheel. This assembly directs the pre-mixing air through perforations into the gas nozzle against venturi-shaped air baffles. The gas and air are thoroughly mixed enroute through the gas nozzle. The outer air ring controls the amount of secondary combustion air admitted to the combustion chamber.

3. Immediate Change-Over to Alternate Fuels

Conversion from gas to oil firing, or vice versa, with this VORIFLOW burner is accomplished in a few seconds on combination units. With the flick of an electric switch, the Powermaster modulating firing controls go into action as soon as the fuel change-over is completed. Latest development for gas firing of packaged boilers, this VORIFLOW burner is one of many reasons why Powermaster is so widely preferred for industrial plants, dairies, hospitals, laundries, schools, public buildings, institutions, and other steam and hot water boiler requirements.

Send for this new bulletin to get the full story of Powermaster's many cost-saving features.

Powermaster®
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi.



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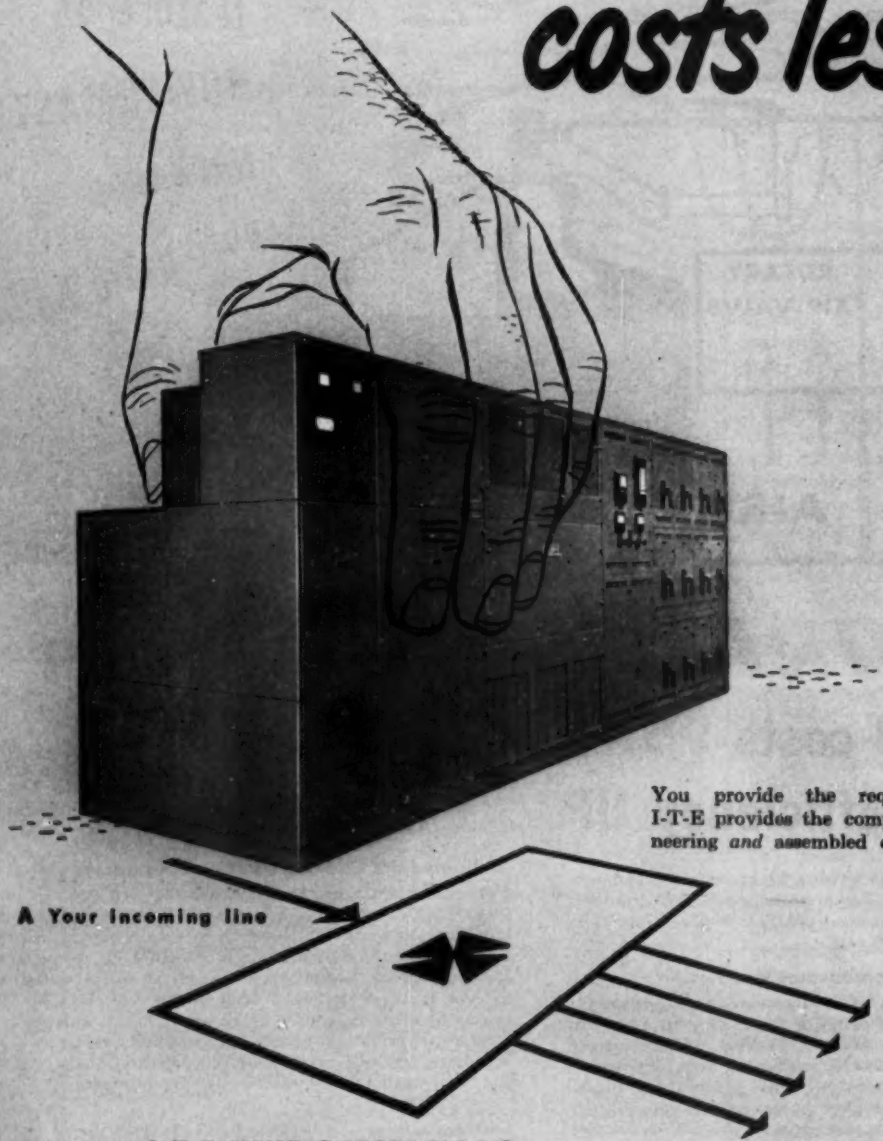


You provide the requirements. I-T-E provides the complete engineering *and* assembled equipment.

I-T-E UNIT SUBSTATIONS

are available in all required ratings, indoor or outdoor, for every service condition. Substations include primary air circuit breakers or interrupter switches, transformers (oil-filled, askarel-filled, air-cooled, or nitrogen-sealed), and secondary air switchgear.

I-T-E Unit Substations for modern plant distribution

Modern plants require the utmost in power distribution efficiency, reliable circuit protection, service continuity, safety, and economy.

Unit Substations—integrated units of stepdown transformers and protective switchgear for location at load centers—have been an I-T-E specialty for many years.

Over-all responsibility

From the incoming lines to the outgoing circuits, I-T-E supplies all the equipment you need—completely coordinated as a package. Furthermore, I-T-E assumes full responsibility—from initial planning, through manufacture, to shipment. Factory-assembled and -tested, *complete* unit substations are delivered ready for installation.

Quality throughout

I-T-E's experienced staff of switchgear engineers assures you professional competence in the selection and application of all components to fit each job. The proved quality of I-T-E products is your guarantee of uniform, outstanding performance, long life, and over-all economy.

See how much I-T-E COORDINATED PLANNING can save you!

There is an I-T-E Application Engineer near you. He will assist you with your specific requirements—and show you how you can save with *complete* I-T-E engineering. Give him a call. *I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.*

I-T-E

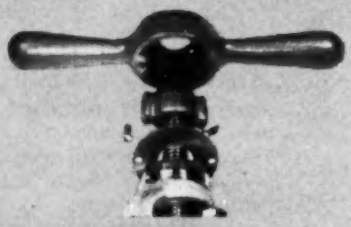
UNIT SUBSTATIONS
for every application

TO AVOID THIS

(WASTING MANPOWER TO OPERATE HARD-TO-CLOSE HIGH PRESSURE VALVES, ESPECIALLY IN AN EMERGENCY)

SPECIFY EDWARD VALVES WITH IMPACTOR HANDWHEELS

One man using an Edward Impactor handwheel can equal the closing force of three strong men on an ordinary handwheel. Saves space, can be operated in cramped quarters, uses no toggle or gears, needs no cinch bars. Standard on many valves, optional on others. Edward catalogs detail its design. Write for literature.



Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

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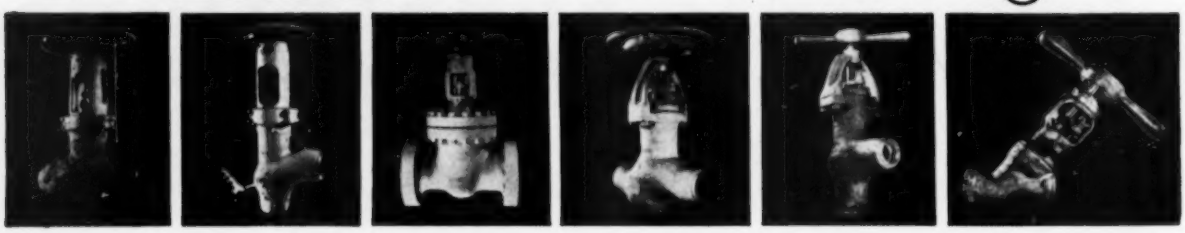
EAST CHICAGO, INDIANA

Another Product



A READER COMMENTS . . . . . .

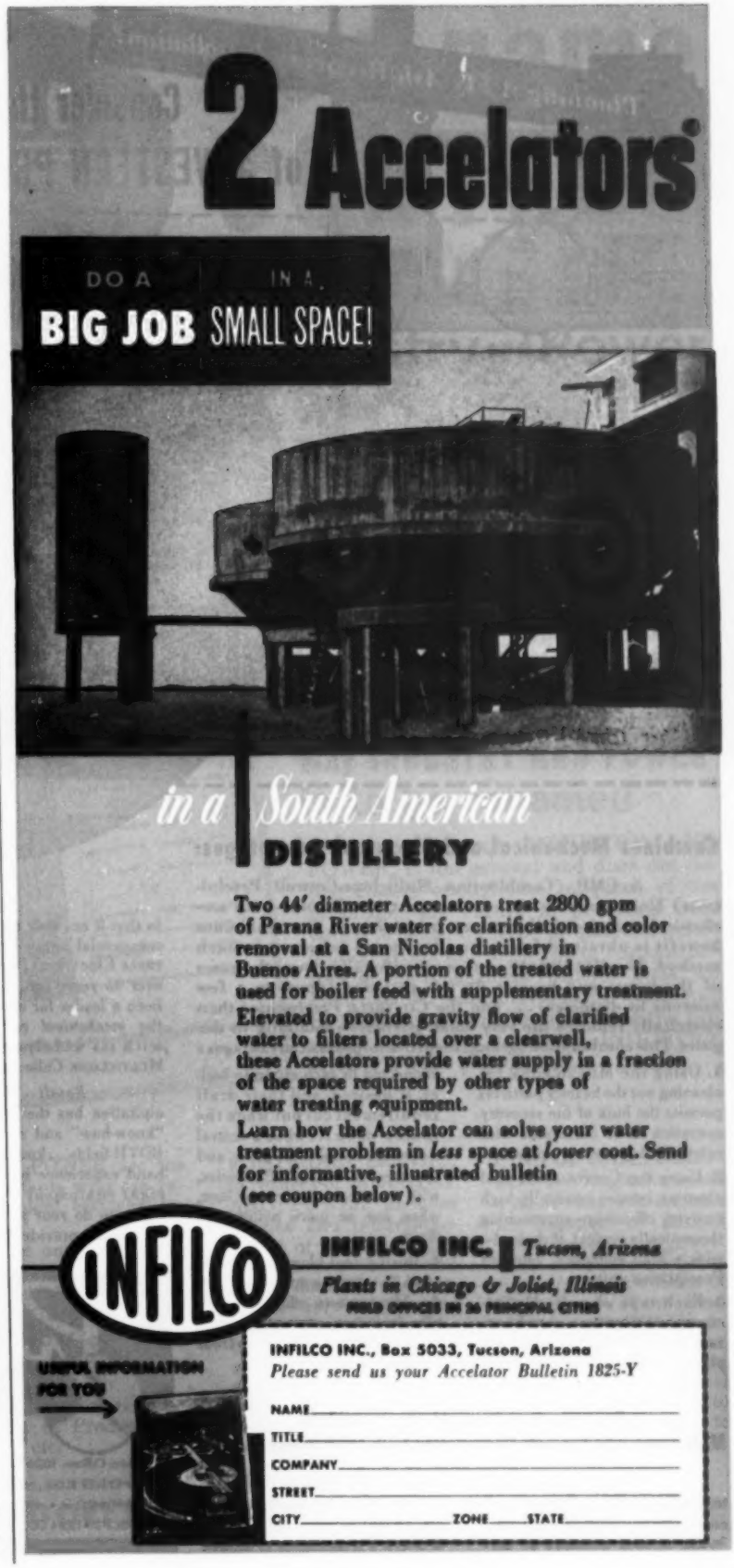
(Continued from page 28)

point and that is the fact that the rated voltages of utilization devices are lower than generator or transformer rated voltages. For instance, on a 480 volt system the generator or transformer would have a rated voltage of 480 volts and the motors a rated voltage of 440 volts. This means that a voltage drop of approximately 8.3 percent in terms of generator voltage is considered normal and satisfactory for a 480 volt system since the motors are designed and rated at 440 volts. This difference between the generator and motor rated voltages is based on recognition of the fact that there will be voltage drops in a system. A further evidence of this fact is presented in the report of the EEI-NEMA Joint Committee on Preferred Voltage Ratings of A-C Systems and Equipment. This report approved a favorable voltage zone for each nominal system voltage. On the 480 volt system, the favorable zone is given as 480-420 volts.

The National Electrical Manufacturers' Association Standards call for a motor being capable of operating successfully for voltages plus or minus 10 percent from nameplate rating. The upper operating limit for a 440 volt motor is then 484 volts. It is apparent, therefore, that the voltage at the motor terminals should not be permitted to exceed 100 percent of the generator rated voltage under any load condition. *A good rule to follow in most cases is to adjust the transformer taps to give rated secondary volts at no load and maximum primary voltage.* At full load and minimum primary voltage, the system voltage drop in modern systems will reduce the load voltage to a value near the rated voltage of the utilization devices. If the load voltage under the full load condition is below the minimum recommended for the utilization devices, the system should be changed or voltage regulators used.

The point to remember is that generator, transformer, and motor rated voltages have been standardized on the basis that there will be some system voltage drop and the rated voltages of the utilization devices must be considered when determining transformer tap voltages or settings. Overvoltages and undervoltages both have bad effects on the performance of utilization devices, and it is important not to operate outside the limits which have been approved for the various devices.

W. R. Crites
Industrial Power Engineer
Industrial Engineering Section
General Electric Company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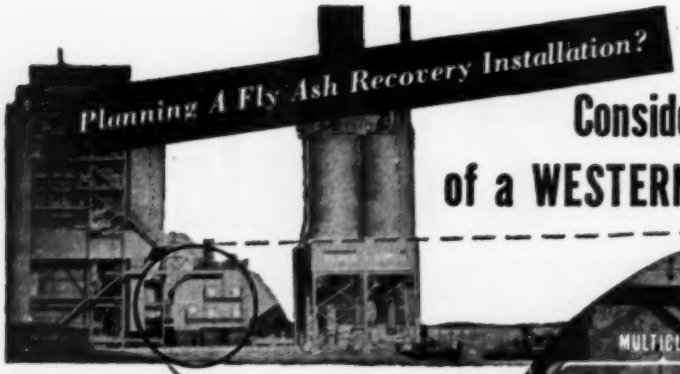
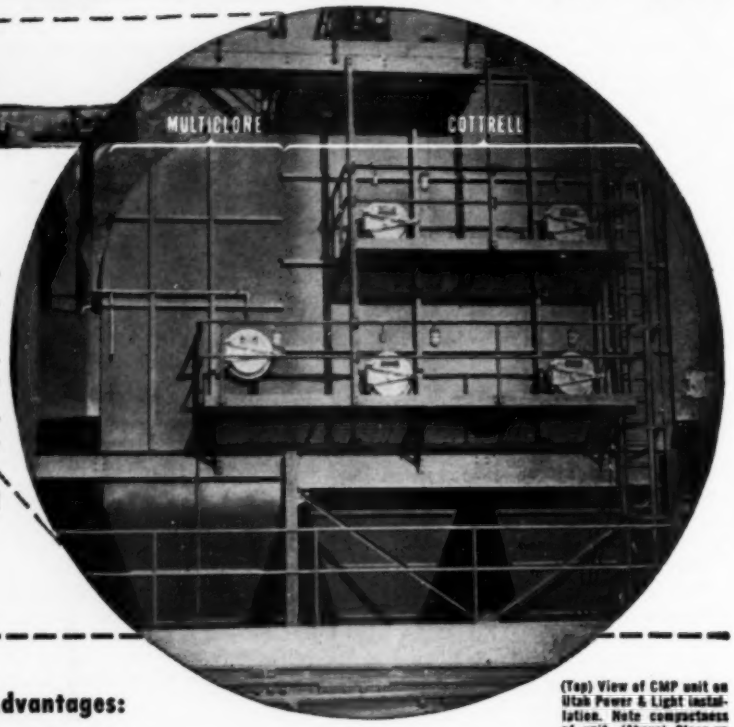


Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!



IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!*

(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

Combines Mechanical and Electrical Advantages:

A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter) . . . and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:

1. Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

2. Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

3. Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down . . . while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

4. During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—In ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

Result—Western Precipitation has the all-important "know-how" and experience in BOTH fields . . . knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job . . . and can provide the complete installation under ONE responsibility and ONE overall guarantee!

Let Our Experienced Engineers study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

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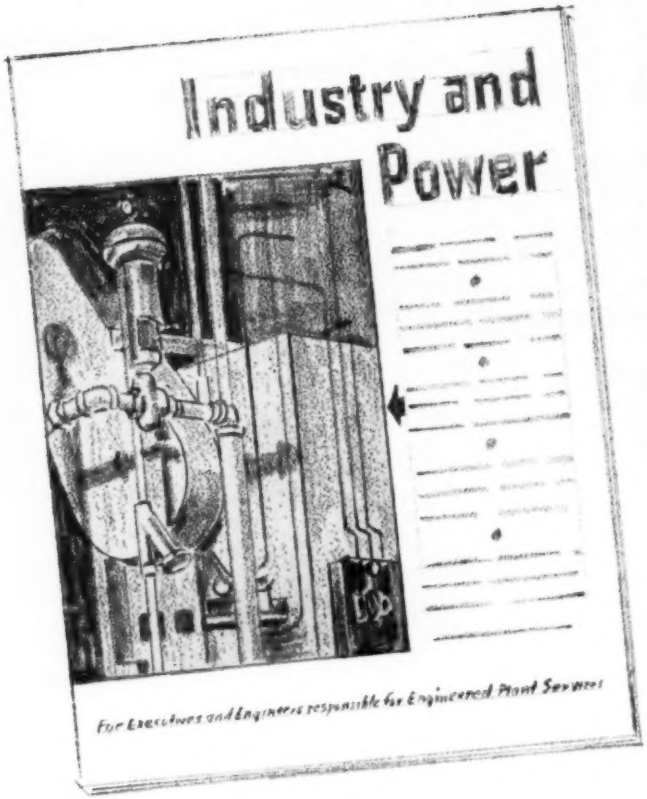
open to all readers of Industry and Power



WIN $100.00 CASH

by suggesting a new name for this magazine

TWO OTHER PRIZES $75 CASH AND $50 CASH

to those submitting the names selected as being second and third best

Why INDUSTRY AND POWER is to be renamed

The present name, INDUSTRY AND POWER, is too general and does not define closely enough the purposes of the magazine, the nature of problems with which it deals, the type of editorial information given, nor the scope of responsibilities of the magazine's readers. Thus, we have decided to look for a name which will be more accurately descriptive of the full range of service to which INDUSTRY AND POWER is dedicated.

READERS OF INDUSTRY AND POWER are the key engineers and executives in plants who are responsible for all the engineered plant services, including:

- Engineered Maintenance
- Materials Handling
- Electrical Distribution
- Steam, Electric and Diesel Power
- Power Distribution and Utilization
- Instrumentation and Controls
- Heating and Air Conditioning
- Industrial Waste Disposal
- Water, Gas & Air Service
- Industrial Lighting
- Engineered Safety and Protection
- Uses of Engineered Services in Production — etc., etc.

EDITORIAL SERVICE to readers of INDUSTRY AND POWER includes articles and information on all of these subjects. Readers are well aware of this breadth of information service provided accurately and thoroughly by the all-engineer editorial staff of this magazine, but the present name falls short of indicating what the magazine does.

KIND OF NAME NEEDED—The magazine needs a name that will indicate its function in dealing with the selection, provision, installation, operation, and maintenance of Engineered Plant Services in industrial plants. It should be a short name, preferably two words, not more than three. It should be a name that is easy to say and, thus, easy to remember.

CONTEST RULES AND OFFICIAL ENTRY BLANK ON OTHER SIDE

(Continued from other side)

RULES governing the naming contest

1. Any reader of INDUSTRY AND POWER is eligible, whether employed by an industrial plant, a manufacturer's sales organization, an advertising agency, or a public utility.
2. Not eligible to compete are employees of INDUSTRY AND POWER or Maujer Publishing Company, nor members of their families.
3. If official entry blank (see bottom of this page) is used, all requested information must be supplied. Entries will be acceptable if submitted on your company letterhead provided you give us the following information:
   a. Typed or legibly printed name of reader submitting the entry
   b. Signature of reader
   c. Name and address of reader's employer
   d. Title or position of reader.
4. An entry may contain two or more *new name* suggestions — as many as you may want to submit.
5. If winning name or either one of the two selected as second and third best is submitted by two or more readers, award in each case will be made to that entry postmarked earliest.
6. Decision of the judges will be final. All entries become the sole property of Maujer Publishing Company.
7. To be eligible, entries must be postmarked not later than July 20, 1953.
8. Address entries to:
   New Name Contest
   Industry and Power
   420 Main Street
   St. Joseph, Michigan
9. New name winners will be announced in the SEPTEMBER issue of INDUSTRY AND POWER, and announcement of when the new name will go into effect will then be made.
10. Judges will be:
    M. J. Sanders, Publisher, Industry and Power
    Hunter R. Hughes, Editor, Industry and Power
    E. R. Gauley, Vice Pres. & Gen. Mgr., Maujer Publishing Company.

NEW NAME CONTEST
INDUSTRY AND POWER
420 MAIN STREET
ST. JOSEPH, MICHIGAN

Date _____

Gentlemen:

Submitted below are my suggestions for new names for INDUSTRY AND POWER:

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My name _____ Title _____

My company _____

Company Address _____

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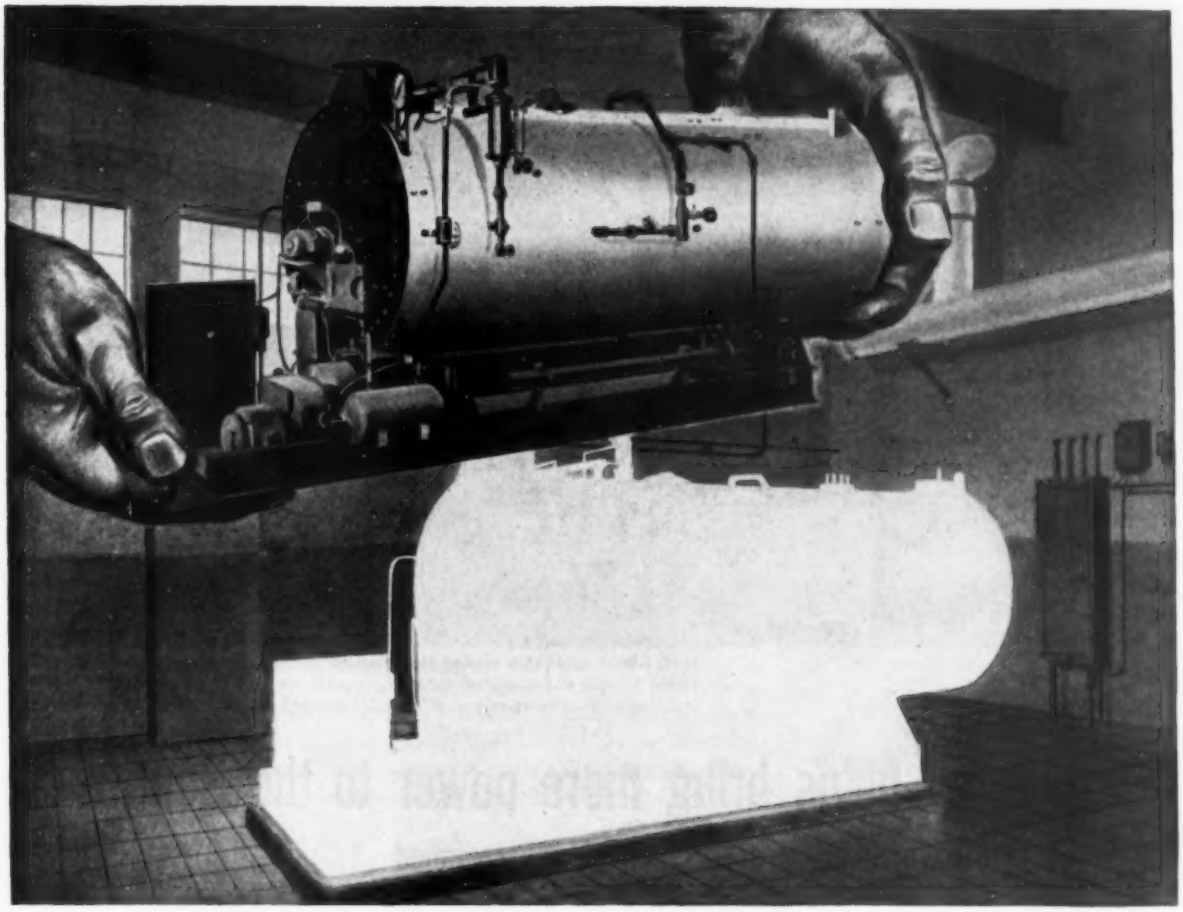

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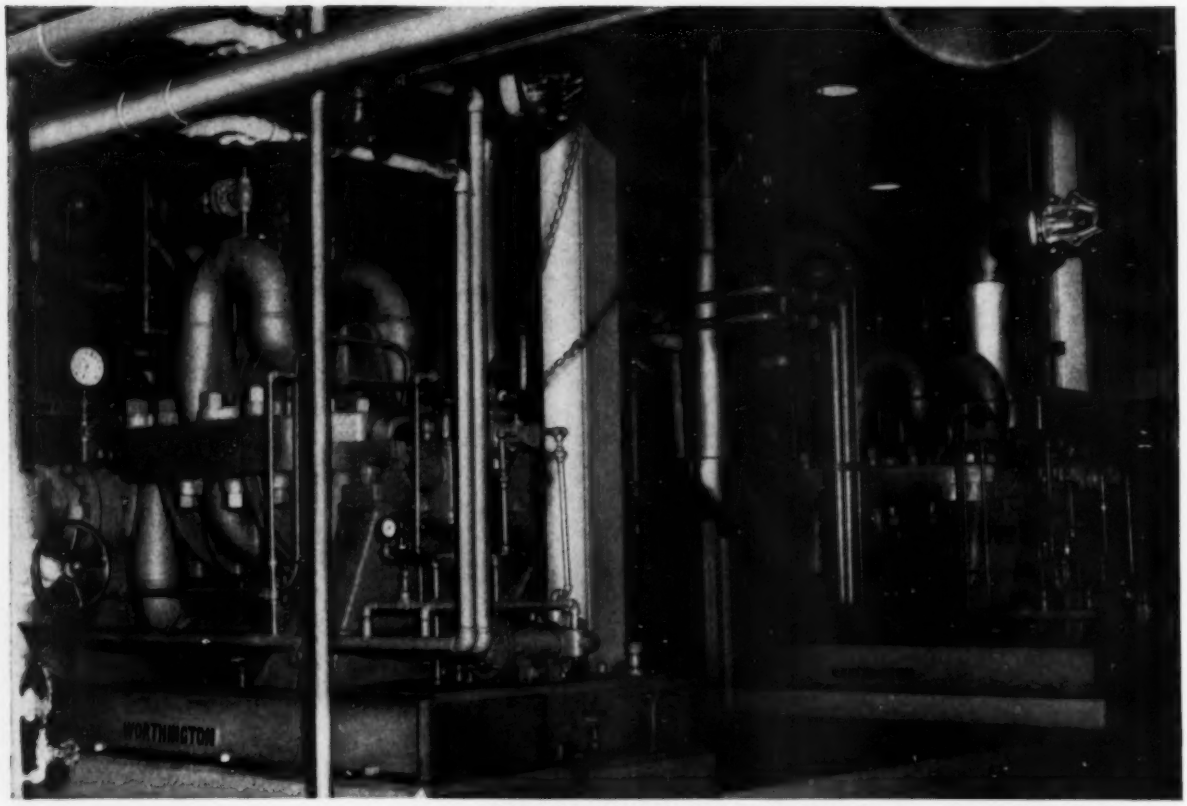
Steam Boilers • Oil and Bitumin Tank Car Heaters • Distillation Equipment Oil and Gas Fired Conversion Burners



THIRTY WORTHINGTON BOILER FEED PUMPS have been purchased by the Southwestern Public Service Company of Amarillo, Texas. The two boiler feed pumps above, installed at Southwestern's new Plant X, deliver 1165 gpm, at 1125 psi total head.

Worthington helps bring more power to the Southwest

30 Worthington boiler feed pumps installed by Southwestern Public Service since 1945

Plant X, ten miles north of Amherst, Texas, is the newest and largest of the Southwestern Public Service Company's eleven generating stations. Since September, 1945, Southwestern Public Service has been expanding, building new stations to meet the Southwest's increasing power needs.

Worthington has played an important part in this expansion. During the past eight years, thirty Worthington boiler feed pumps have gone into Southwestern Public Service power plants. In Plant X alone, Worthington has supplied, in addition to the boiler feed pumps, heater drain pumps, water softeners, sump pumps, air compressors, and the open feed-water heater.

Power engineers everywhere have found that Worthington has kept pace with the increase in capacity and pressure of steam generating units and is prepared to furnish boiler feed pumps for any modern power plant requirements.

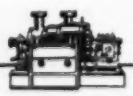
We'd like to hear about your own pumping problems. Get in touch with your nearest Worthington district office, or write directly to Worthington Corporation, Centrifugal Pump Division, Section C.3.5, Harrison, N. J.

C.3.5

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.

For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.



For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

WORTHINGTON

Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job

COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

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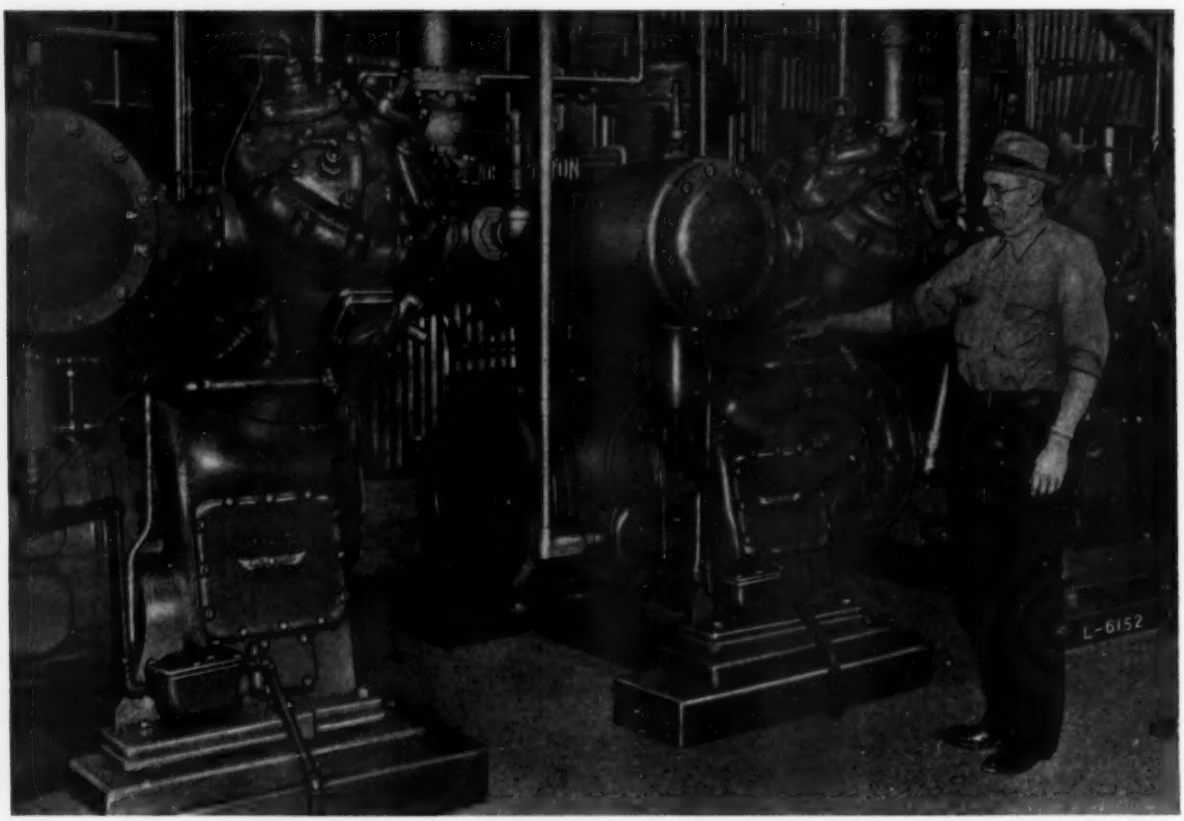
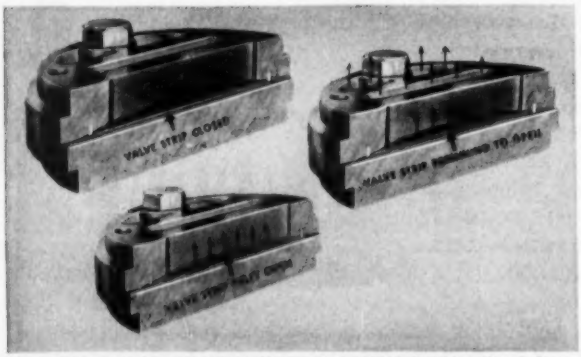
(Write here any special ventilating problem you may have.)



WORTHINGTON TYPE YC-2 COMPRESSORS supplying compressed air for the Coos Bay, Oregon plant of the Evans Products Company. These units are supplied with high-efficiency Three Step Variable Capacity Control.

Coos Bay plywood plant smooths out vibration problem



THE QUIET-OPERATING WORTHINGTON FEATHER* VALVE is made up of a series of thin flexible strips of ribbon steel, held in position over rectangular openings, by curved milled guards. The valve strips lift and flex uniformly against the curved guards. In addition to quiet operation, the absence of impact results in long valve life and low maintenance costs.

Heavy vibration had caused tube trouble in the steam generating equipment at the Coos Bay, Oregon, plant of the Evans Products Company.

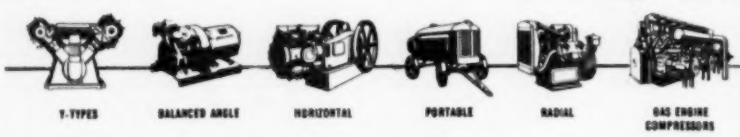
When it came time to install new compressors in this critical area, plant engineers solved their problem by choosing two quiet-running Worthington YC-2's.

After three years, the low-vibration performance of the two Worthingtons was so satisfactory that another YC-2 was ordered and installed this year—making an all-Worthington compressor installation.

Contributing to the smooth operation of Worthington compressors are the exclusive Worthington Feather* valves—the lightest, simplest and most efficient valves ever developed for compressor operation. Valve seating is always quiet and positive.

Write us about your compressor problem. Worthington Corporation, Compressor Division, Section K.3.1, Buffalo, New York. K.3.1

*Reg. U. S. Pat. Off.

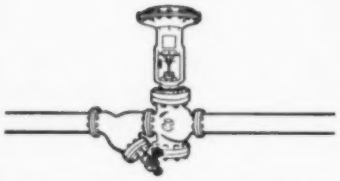


ONLY WORTHINGTON COMPRESSORS
GIVE YOU FEATHER VALVE PERFORMANCE

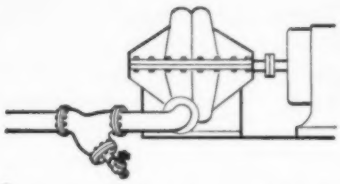
WORTHINGTON
Compressors

Which of over 150 Leslie strainers is the one for YOUR job?

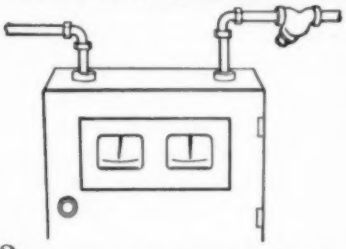
THREE "MUSTS" FOR GOOD PIPING PRACTICE . . .



1. **For protection of control valves.**



2. **Protection of pumps, turbines and process equipment.**



3. **For superfine cleaning of air, steam and liquid flows, Leslie "Poromet" filters trap particles down to .001".**

WHICH WILL GIVE COMPLETE PROTECTION AT LOWEST COST?

Just considering strainer body material and screen specifications alone, there are over 150 *standard* combinations of "Y" type Leslie strainers. Each is engineered to do specific jobs under specific conditions . . . there's a "Leslie" for any industrial or marine pipeline strainer application.*

Then, with the myriad of pipe sizes and end connections, it's apparent that picking the right strainer to protect valuable equipment exposed to flow is *not* a "pin-the-tail-on-the-donkey" task

*There are standard units for pressures to 2500 psi; temperatures to 1050° F; semi-steel, cast bronze, cast steel and cast alloy steel; screwed, flanged, welding or ring-type ends; sizes from ⅛" to 1".

RESERVE YOUR FREE COPY OF 12 PAGE BULLETIN 5308

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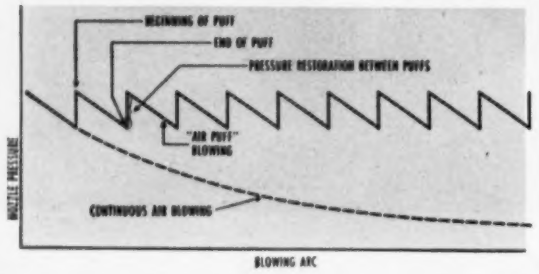
TRADE LESLIE MARK

THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS
Since 1900

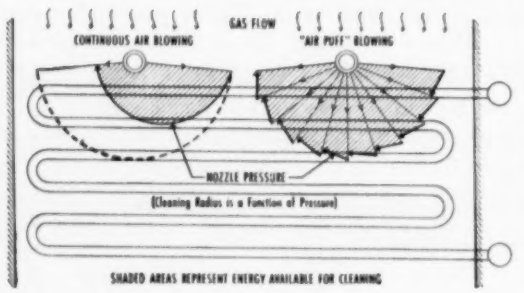
LESLIE CO., Grant Avenue, Lyndhurst, New Jersey

Why the Diamond Automatic "AIR PUFF" Principle of Soot Blowing means Cleaner Boilers at Lower Costs

Controlled, HIGH SUSTAINED Air Pressure Throughout Each Puff
(Independent of Receiver Capacity and Compressor Size)



Representation of Typical Puffing Application
Puffs are Measured—Have Identical Travel Arcs


GAS FLOW
CONTINUOUS AIR BLOWING
"AIR PUFF" BLOWING
NOZZLE PRESSURE
(Cleaning Radius is a Function of Pressure)
SHADED AREAS REPRESENT ENERGY AVAILABLE FOR CLEANING

Model A2E Automatic "Air Puff" Soot Blower Head

The Diamond Automatic "AIR PUFF" Soot Blower is a precision machine with all functions carefully controlled and interlocked to provide better boiler cleaning at lower cost.

Definite cleaning advantage is obtained; first, as a result of using air at high density as a cleaning medium, and second, by employing the well-known puff or "shock" method of creating a large number of powerful impulses.

As illustrated schematically at the left, the controls function in such a manner that air issues from the multiple nozzles in *sustained* high pressure puffs that are independent of receiver capacity and compressor size. During each puff, the element rotates through a predetermined and measured short arc. Then the valve shuts off and the element stops rotating during the timed interval while the compressor restores the original air pressure . . . after which the valve reopens and the element starts rotating again for the next puff.

The action is entirely automatic, and when the cycle is completed the blower shuts off. Each blower head is automatically started and operated in turn until the cleaning operation is completed.

This combination of *sustained* high pressure puffs with precise rotation of the element through a measured arc each time assures thorough cleaning at less cost. No air is wasted at low pressure when it cannot clean effectively. Controlled element rotation uniformly covers all the surface to be cleaned.

The Diamond "Air Puff" principle permits use of much smaller, less costly compressor and receiver equipment. Air puff blowers can be operated while the boiler is on automatic operation. Dust loading control is another important advantage. Control being entirely automatic, the expense and uncertainty of the human element are eliminated. Write for further information.

DIAMOND POWER SPECIALTY CORPORATION
LANCASTER, OHIO
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Windsor, Ontario

50th ANNIVERSARY 1903-1953

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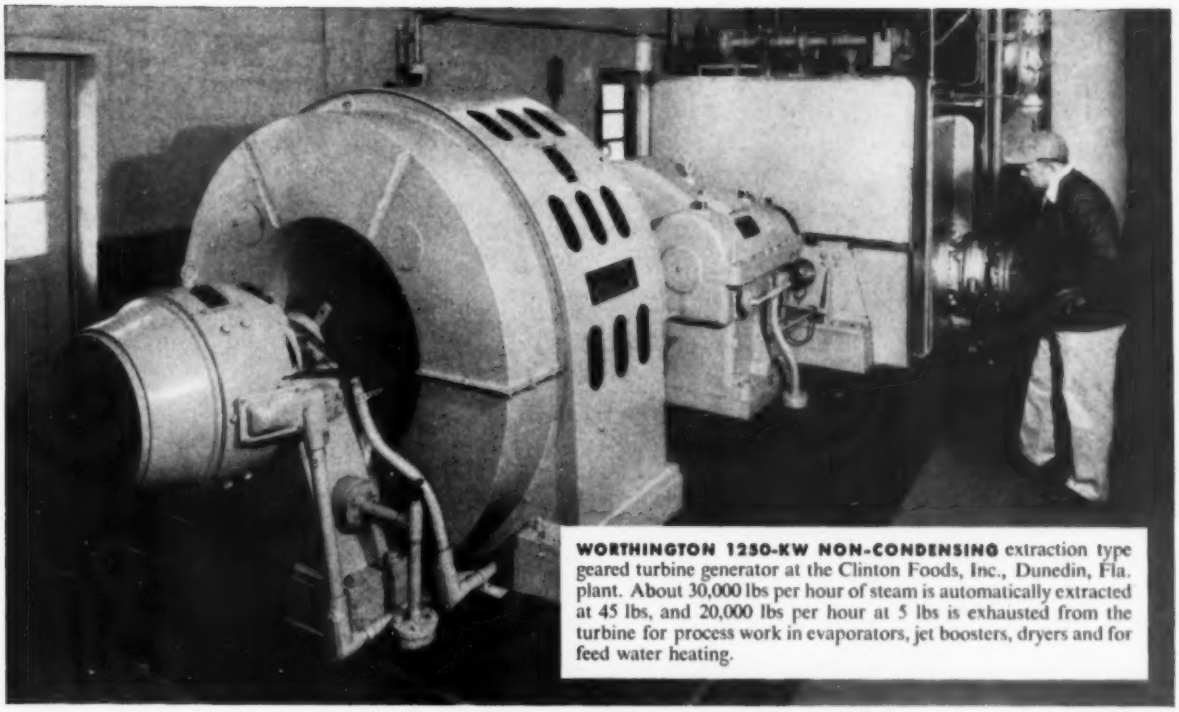


WORTHINGTON 1250-KW NON-CONDENSING extraction type geared turbine generator at the Clinton Foods, Inc., Dunedin, Fla. plant. About 30,000 lbs per hour of steam is automatically extracted at 45 lbs, and 20,000 lbs per hour at 5 lbs is exhausted from the turbine for process work in evaporators, jet boosters, dryers and for feed water heating.

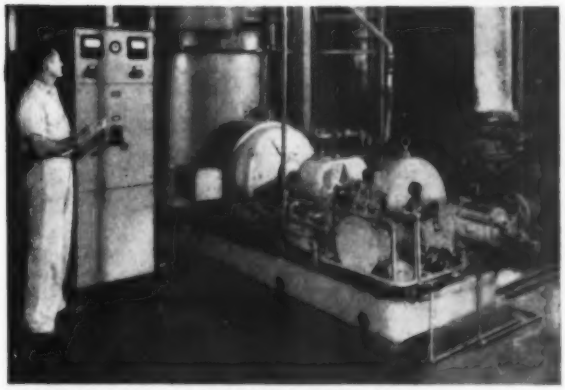
Process steam generates low-cost electricity at Florida orange juice plant

Turbine-generator installation pays for itself in three years

Clinton Foods decided to put some of their process steam to work generating electricity for their plant in Dunedin, Fla. After investigating many kinds of power equipment, plant engineers decided on a 1250 kw Worthington geared turbine-generator set.

After 3 years, the Worthington unit has completely returned its investment in added production and reduced electrical power costs.

So successful was the operation of this unit that Clinton Foods installed another Worthington machine at their by-products mill in their main plant at Auburndale, Fla. This is a 250-kw non-condensing turbine-driven induction generator. Here again, dependable power is supplied in addition to controlled pressure steam taken from the turbine exhaust. This Worthington unit paid for itself in one season. A 7500-kw unit is now being built for the Clinton plant in Clinton, Iowa.



WORTHINGTON 250-KW TURBINE DRIVEN induction generator at Clinton Foods, Inc., plant, Auburndale, Fla. Unit acts as a kw producing-reducing valve and has paid for itself after one season's operation.

By installing Worthington turbine generators, Clinton Foods were assured of low cost power and steam. They were also assured of the undivided responsibility that goes with turbine generators designed, assembled and tested as *complete Worthington units* before shipment.

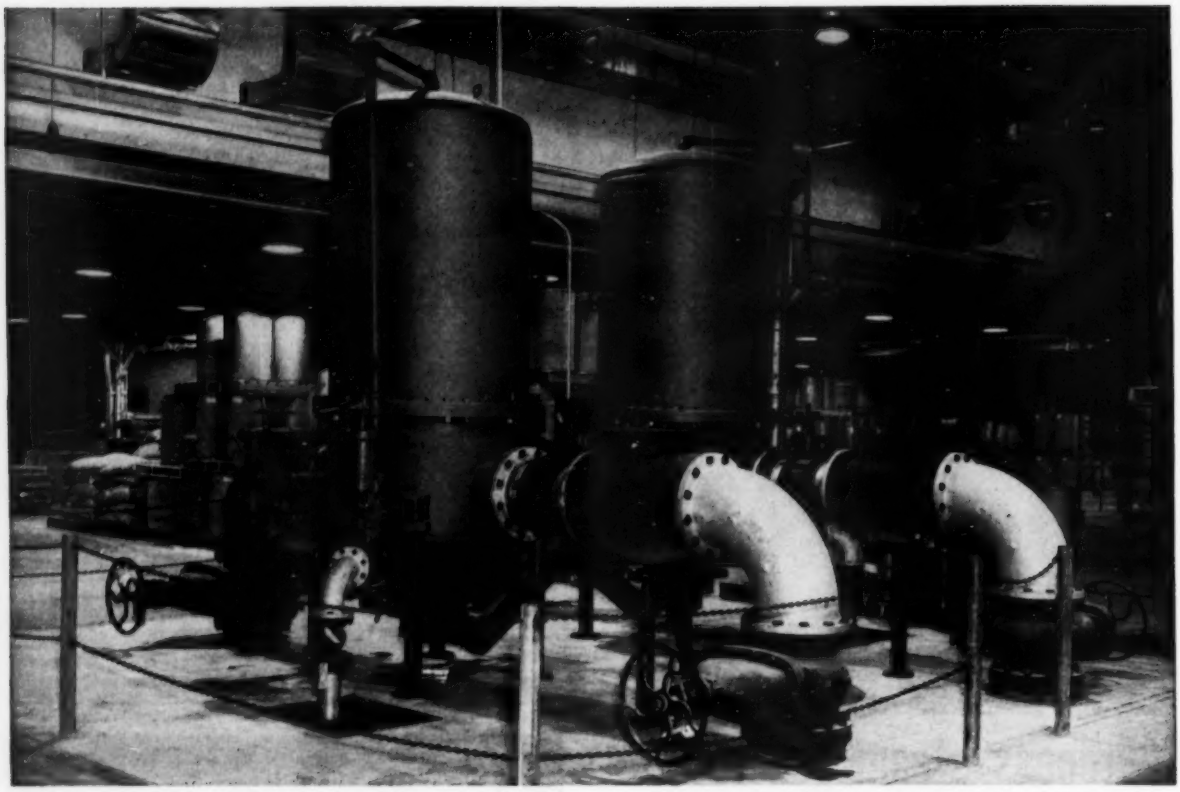
Sizes to 11,500 kw. For more information, write your nearest Worthington district office, or Worthington Corporation, Steam Turbine Division, Section T.3.1, Wellsville, New York.

T.3.1

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators



EVERY GRAIN OF SAND IS REMOVED from the well water passing through these abrasion-resistant FLO-KLEAN filters at the new Upjohn Company plant in Kalamazoo, Michigan.

Upjohn saves 2000 dollars a month

FLO-KLEAN filters protect valuable equipment at pharmaceutical plant

Maintenance records at the Upjohn Company's ultra-modern plant near Kalamazoo, Michigan, show that FLO-KLEAN filters are responsible for saving up to $2000 a month in maintenance costs.

These Cuno FLO-KLEAN filters, used to remove sand and gravel from incoming well water, ordinarily take something like a teaspoon of sand out of each thousand gallons. That doesn't appear to be an impressive quantity, but it could cause serious damage to stainless steel valves, pumps, water softeners, condensers and other valuable equipment. Purity of process water is assured by the high-capacity FLO-KLEAN units.

Recently the wall of one of their thirteen 250 feet deep wells gave way, dumping large quantities of sand and gravel into the water system. Every bit of this sudden deposit (almost seven cubic yards) was removed by the FLO-KLEAN filters. Without interrupting service, FLO-KLEAN continued its automatic operation and saved Upjohn a serious operating and maintenance loss.

In hundreds of applications throughout industry the fully automatic, continuously self-cleaning FLO-KLEAN filters have paid for themselves many times over by making river, lake, or well water fit for industrial use . . . and without loss of backwash water. Other uses include reclaiming industrial process water and coolants. If you need or use between 200 and 100,000 gallons per minute of clean water, find out how FLO-KLEAN can save you money. Write for free FLO-KLEAN bulletin to the Cuno Engineering Corporation, Dept. 141-F, Meriden, Conn. 3.1

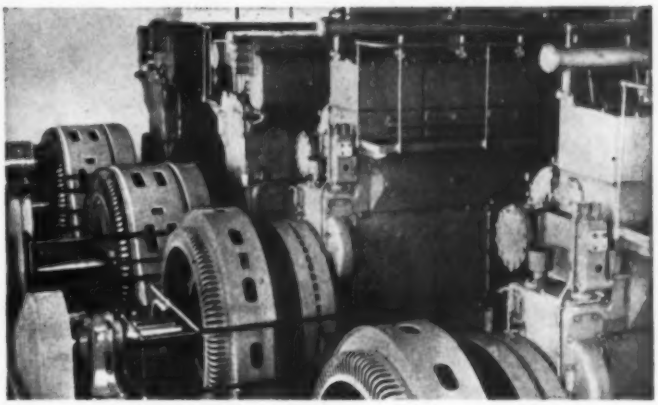
CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

"12,000 H.P. Hours per Gallon with Sinclair RUBILENE"



...says Leo D. Bradley, Manager
Western Michigan Electric Co-operative, Scottville, Michigan

"Our two Cooper Bessemer super-charged 1600 H.P. Model LS8T diesels deliver over 12,000 H.P. Hours per gallon of Sinclair RUBILENE H.D. Oil consumed," says Leo D. Bradley.

"We give much of the credit to the quality of this oil," continues Mr. Bradley. "RUBILENE® keeps our diesels exceptionally clean. Wear is kept at a minimum – the result is high efficiency... low operating costs... and low maintenance cost."

Sinclair Products have been used since the generating station first went into operation – 12 years ago. The recommendations made by a Sinclair Lubrication Engineer at that time plus continuous counseling service and superior Sinclair Products have meant substantial savings for this co-operative.

Perhaps a Sinclair Lubrication Engineer can help solve some of your lubrication problems. Phone your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

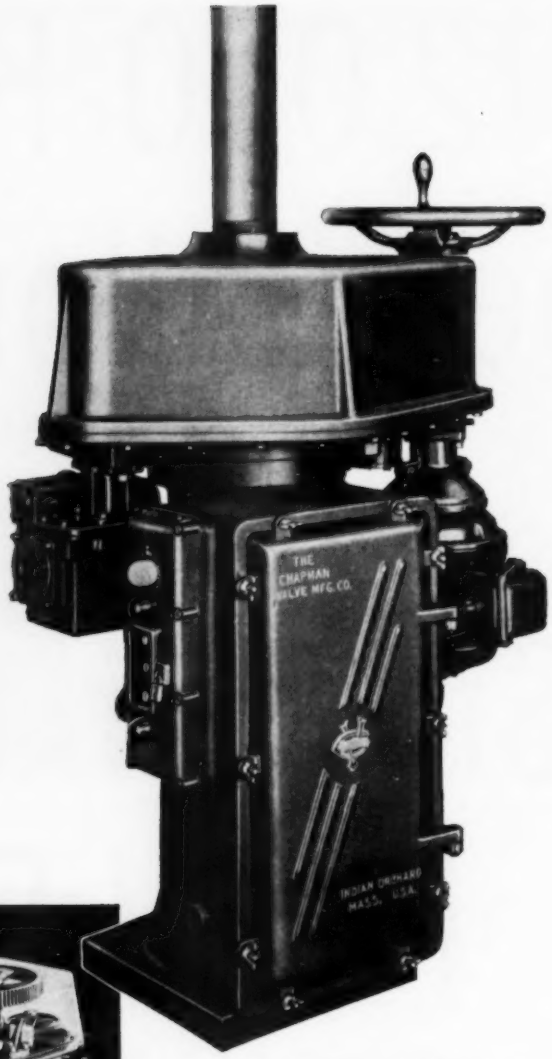
SINCLAIR DIESEL LUBRICANTS
prolong engine life

RUGGED BOSS

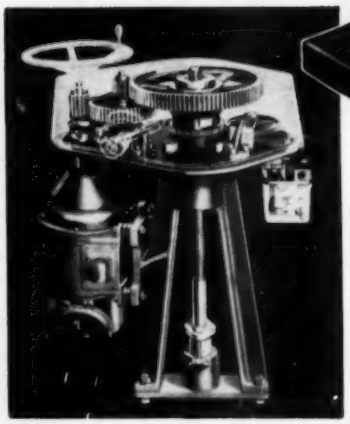
for Valves, Sluice Gates and Floorstands...

CHAPMAN'S

Motor Unit

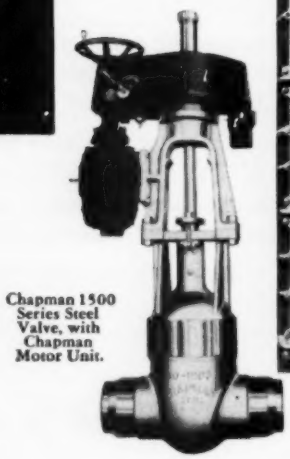


Above, Floorstand equipped with Chapman Motor Unit, Control Panel, Motor, Limit Switch and Push Button Station all completely wired. At left, Interior Mechanism of Chapman Motor Unit.

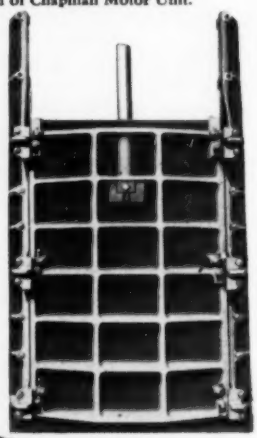


For positive control of large valves and sluice gates, the Chapman Motor Unit can safely be given your "power of attorney." The floorstands with Chapman Motor Units come to you with all wiring *complete*, so that all you have to do is bring the power leads into the connection box... which speeds up installation, insures proper operation, and saves wiring costs.

The Chapman Motor Unit is completely housed and thoroughly weatherproof. And the unit itself has the ruggedness of simplicity, with a slow-speed motor driving direct through two trains of spur gears. So there's no drift. The limit switch can be adjusted so the gate or valve closes to the exact seating position. Hand-operated, too, if the need arises. See what this modern electrically driven Motor Unit can do — *and save* — for you. Write for Catalog No. 50.



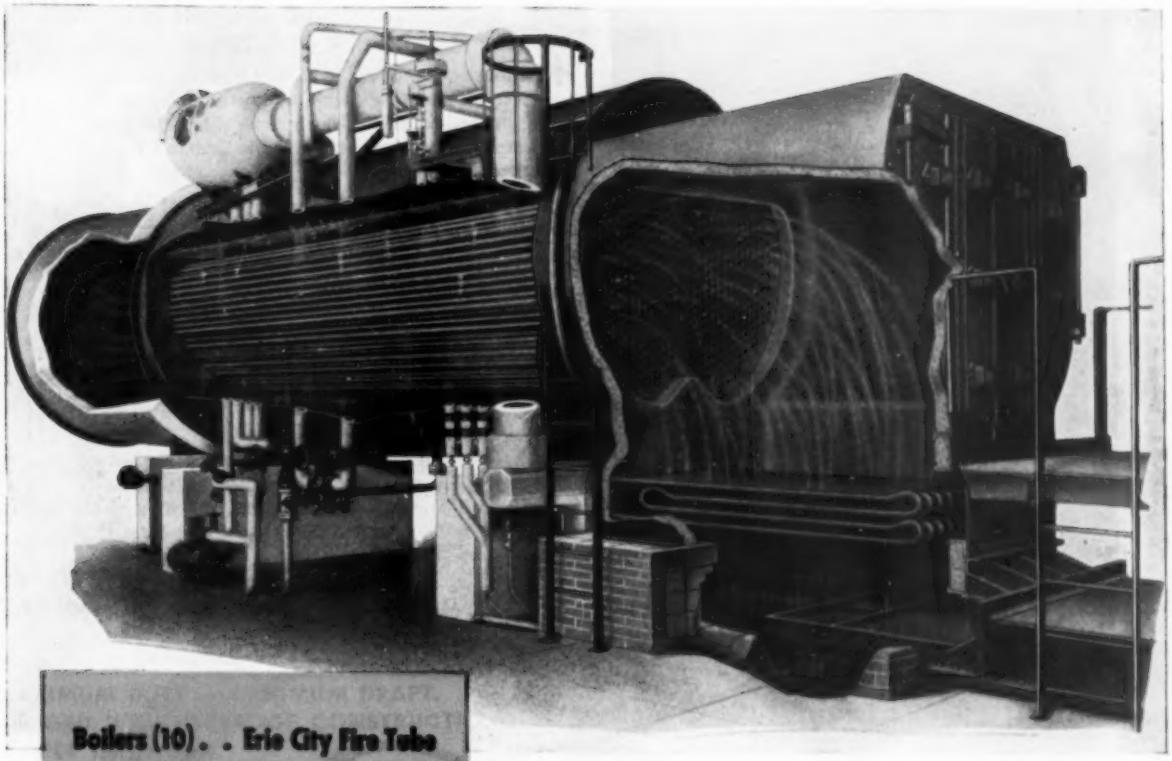
Chapman 1500 Series Steel Valve, with Chapman Motor Unit.



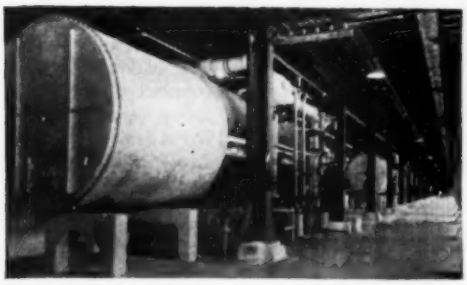
Chapman Standard Sluice Gate, with stem connection for Chapman Motor Operated Floorstand.

The CHAPMAN VALVE Mfg. Company

INDIAN ORCHARD, MASSACHUSETTS, U. S. A.



Boilers (10) . . Erie City Fire Tube
Design Pressure . . . 300 p. s. i.
Capacity . . . . 15,000 lbs/hr.
Superheated Steam Temperature . . . 525° F
Fuel . . Waste gases from Open Hearth furnace enter boiler at about . . . . 1200° F



10 Erie City Fire Tube Boilers each "fired by" waste heat gases from Open Hearth Furnace

Stop giving WASTE HEAT

A Free Ride from your Open Hearths

Nickle Furnaces • Zinc Furnaces • Copper Furnaces
Cement and Lime Kilns • Incinerators • Ore Roasters
Silicate Furnaces • Chemical Industry Furnaces
Paper Industry Furnaces

IN these days of increased operating costs investigate the economy of waste heat recovery. A large steel producer tapped a source of wasted B.t.u.'s from 10 Open Hearths and converted them into 150,000 lbs. of 525° superheated steam per hour. Fuel is the big cost in steam generation; therefore "free fuel" will give you a head start in your steam generating program.

Erie City manufactures a complete line of fire tube and water tube waste heat type boilers and has wide experience in heat recovery.

Outline your waste heat conditions—our experience is yours for the asking.

You can depend on Erie City for sound engineering

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

Guaranteed TO SHUT TIGHT*

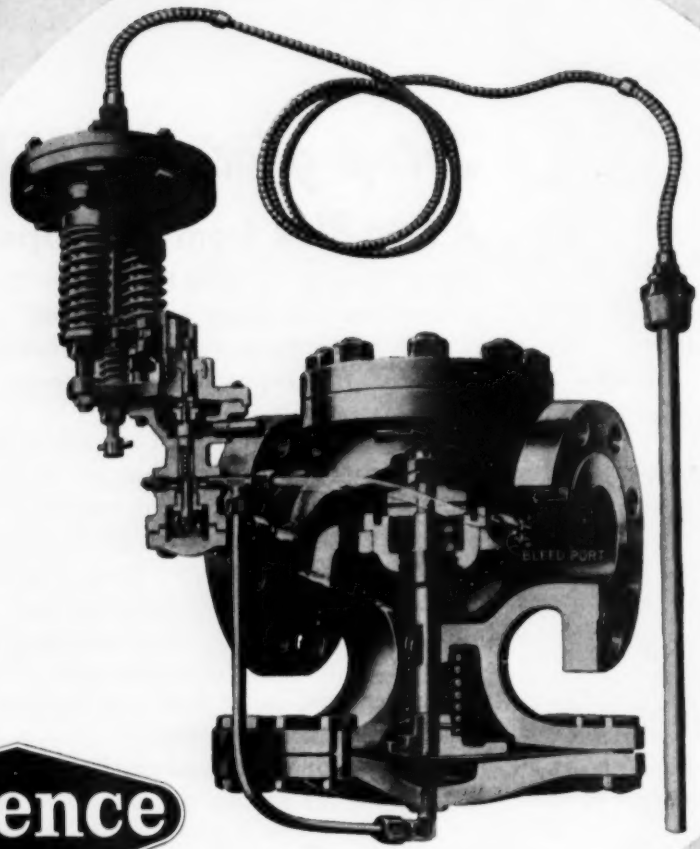
*When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

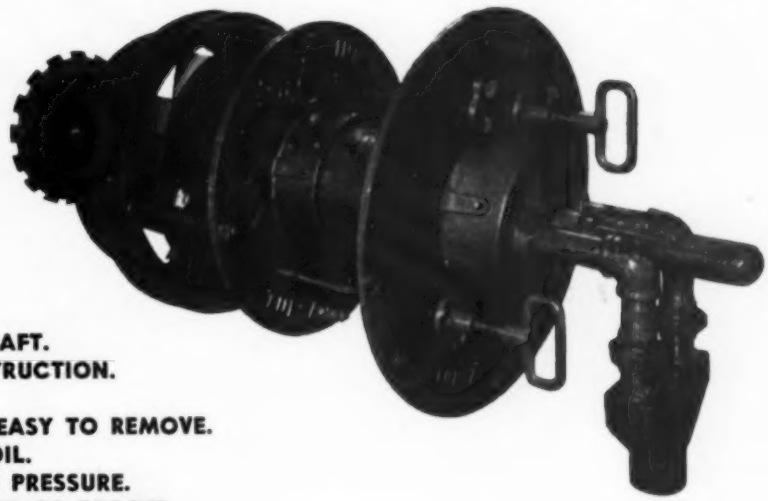
Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

JOHN ZINK JZ SERIES YC

COMBINATION GAS & OIL BURNER

The John Zink Series YC Combination Gas and Oil Burner is particularly designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance at low first cost.



MAXIMUM DUTY — MINIMUM DRAFT.
RUGGED WEATHERPROOF CONSTRUCTION.
SIMPLE IN DESIGN.
LIGHT-WEIGHT FUEL GUNS ARE EASY TO REMOVE.
BURN ANY COMMERCIAL FUEL OIL.
BURN ANY GAS AT REASONABLE PRESSURE.
DRAFT MAY BE NATURAL, INDUCED OR FORCED.
CHROMIUM ALLOY STEELS FOR HEAT AND CORROSION RESISTANCE.
CENTER FIRING WITH BOTH FUELS ASSURES EQUALLY SATISFACTORY OPERATION WITH EITHER FUEL.
ANY AIR TEMPERATURE MAY BE USED.

JOHN ZINK AIR HEATER

John Zink Air Heaters are already being reordered—they must be good. Air Heaters, individually fabricated to meet specifications, are available as Horizontal or Vertical Units. Equipped with a special JZ Air Heater Burner, electric ignition gas pilot and complete safety control equipment as specified. John Zink will furnish the burner for your fabricated heater.

JOHN ZINK FIELD FLARE BURNERS For . . .

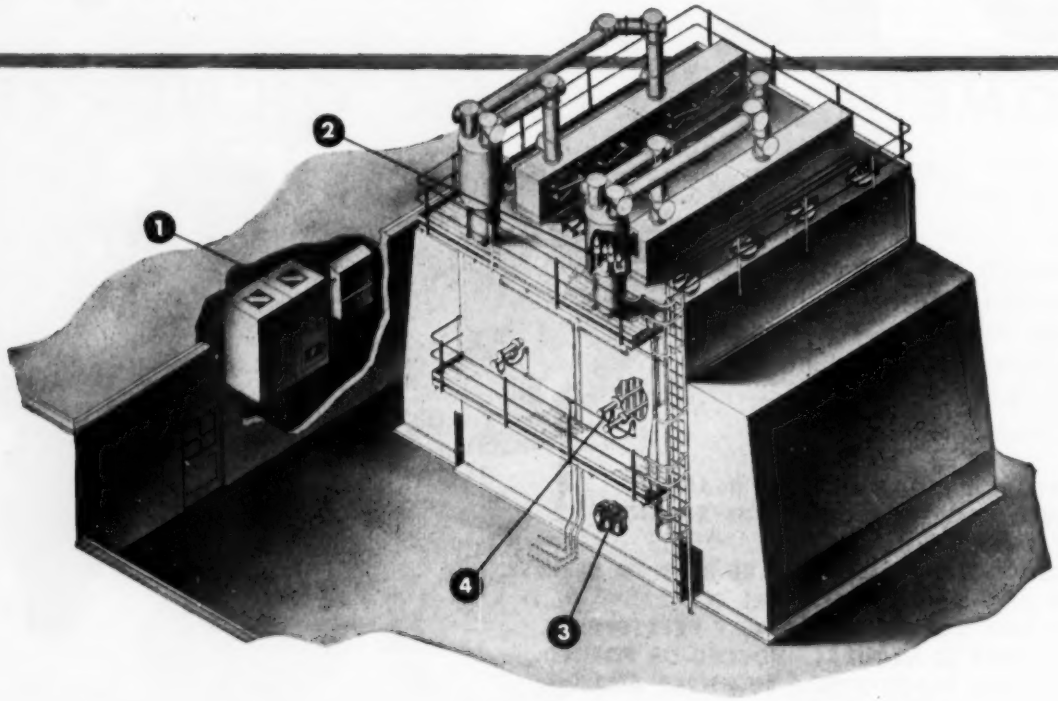
- OIL REFINERIES
- CHEMICAL PLANTS
- STEEL MILLS
- GASOLINE PLANTS
- SEWAGE DISPOSAL PLANTS

or any industrial facility where substantial volumes of combustible gases must be dissipated.

JOHN ZINK COMPANY

4401 So. Peoria **Tulsa, Oklahoma**

What's New in Electrical Precipitators?



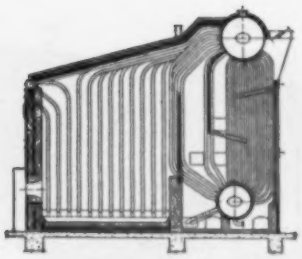
FEATURES:	RESULTS:
1. Remote Control—Entire installation is operated by switchboard control from any convenient location.	**1.** Central control room operator can see all meters and operate all controls that determine optimum performance.
2. Low-cost Energization—Weatherproof high voltage transformer and electronic tube rectification equipment allow location flexibility and minimum power consumption.	**2.** Space conservation, short high voltage connection between rectifiers and precipitators insure compact, economical installation.
3. Unique Electrode Design—Plumb-bob discharge electrodes, individually weighted to remain taut, are uniformly positioned by a lower framework.	**3.** Discharge wires are kept perfectly aligned at all times for maximum overall precipitator performance.
4. Electronically Controlled Rapping—New magnetic impulse rappers are designed for continuous, sequential, smoothly regulated electrode rapping.	**4.** Eliminates stack puffs and produces increased overall efficiency.

Ask your Research Corporation representative to bring you up to date on the details of these and many other improvements that you will find in the modern Cottrell Electrical Precipitator.

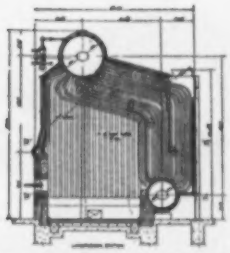
RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
Bound Brook, N. J. • Grant Building, Pittsburgh 19, Pa.
122 South Michigan Avenue, Chicago 3, Ill.

RC-143



2 Drum Water Tube Boiler



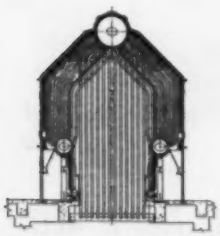
Type-S 2 Drum Boiler Series 51

FOR ALL INDUSTRY . . .

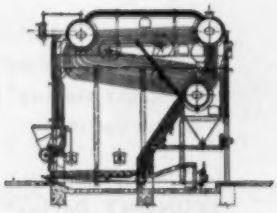
WICKES

STEAM GENERATORS

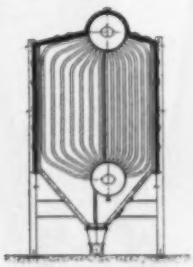
• In the oil, paper and chemical industries and in manufacturing plants, institutions and public buildings throughout the world Wickes Steam Generators are in constant daily service. All types, such as those illustrated on this page, with capacities up to 250,000 lbs. steam per hour and 1000 psi. Write for descriptive literature.



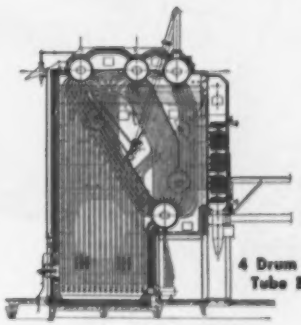
"A" Type Water Tube Boiler



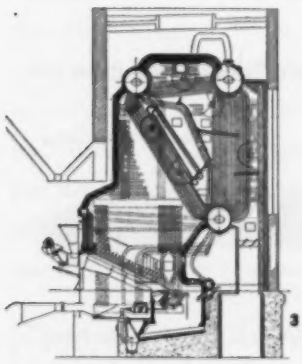
3 Drum Low Head Water Tube Boiler



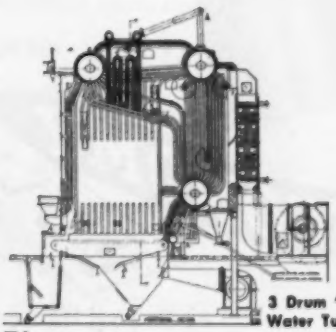
Wickes 2 Drum Waste Heat Installation



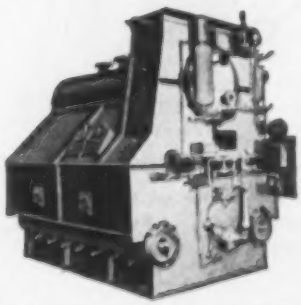
4 Drum Water Tube Boiler



3 Drum Water Tube Boiler



3 Drum "B" Type Water Tube Boiler



Type "A" "Packaged" Steam Generator

THE WICKES BOILER COMPANY • DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

Because you use *the same* **"ECONOMY** *De-Lay"* Cartridge over and over again.

You renew a "blown" **ECONOMY** *Fuse* by simply inserting an inexpensive "ECONOMY DE-LAY" *Renewal Fuse Link* in the old Cartridge.

You reduce "lights out" and "machine down time" because **"ECONOMY** *De-Lay" Fuse Links* are replaced in a few seconds.

Your investment in **"ECONOMY** *De-Lay" Fuse Links is much smaller than the investment required* if you use non-Renewable Fuses for each fuse replacement.

Ask for the ECONOMY *Catalog and Price List.*

SM71

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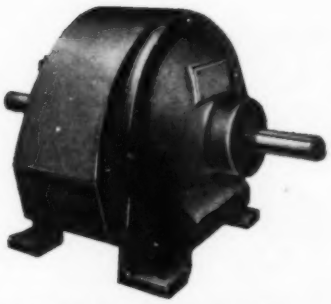
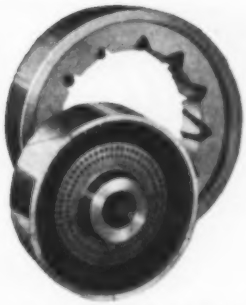
Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

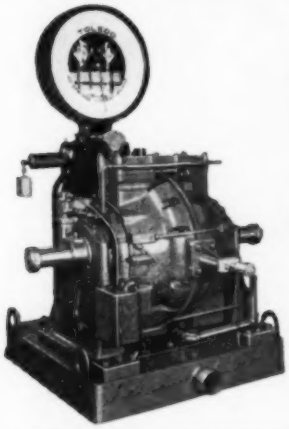


AIR COOLED COUPLINGS

AJUSTO-SPEDE MOTORS



AIR COOLED BRAKES



ABSORPTION DYNAMOMETERS

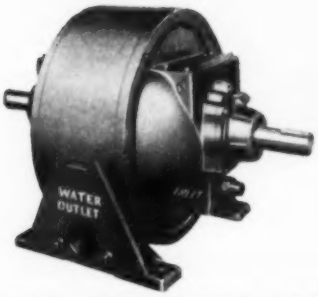
EATON

DYNAMATIC

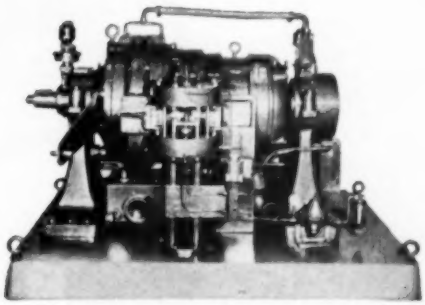
®

EDDY-CURRENT ROTATING EQUIPMENT

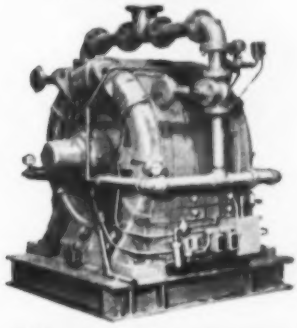
PRESS DRIVES



LIQUID COOLED COUPLINGS



UNIVERSAL DYNAMOMETERS



LIQUID COOLED BRAKES

Dynamatic Eddy-Current electro-magnetic equipment represents the ideal solution for a wide range of adjustable-speed drive problems, particularly where an AC power source is a requirement. Typical applications include paper machine drives, cement mill drives, industrial truck clutches, press drives, crane brakes, fan drives—in fact, practically all test, processing, and conveying equipment common to industry. Instantaneous response and accurate control are important advantages.

Write for your copy of Bulletin GB-1 which describes and illustrates the basic Dynamatic units.

DYNAMATIC ® CORPORATION KENOSHA • WISCONSIN

Subsidiary of EATON MANUFACTURING COMPANY, Cleveland, Ohio

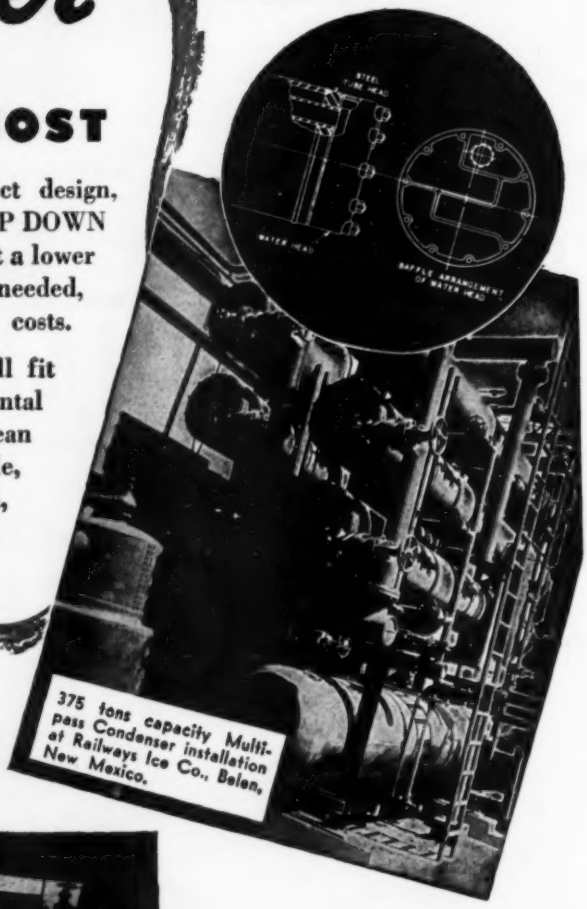
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

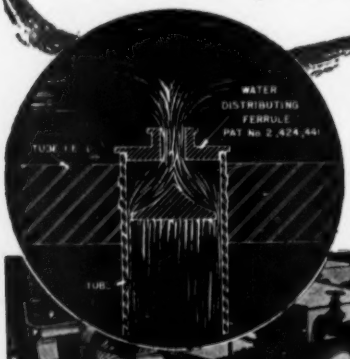
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

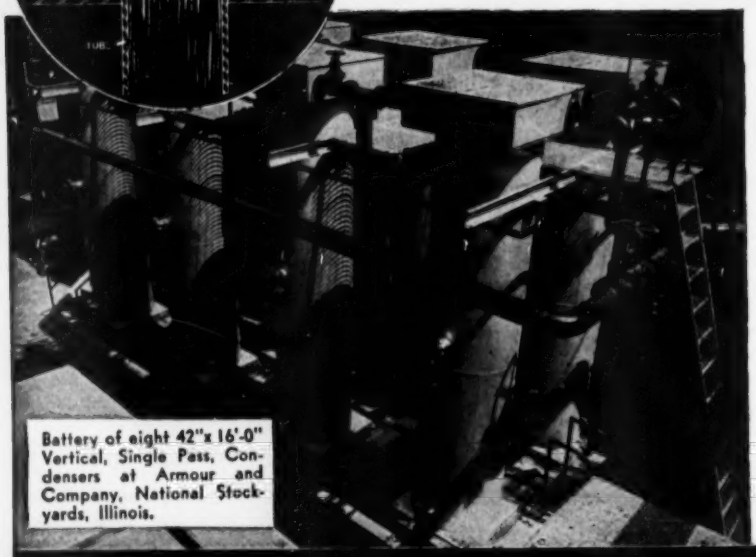


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



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load: 610 lb.

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fig. 221
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fig. 222

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fig. 168
½ to 3 IPS

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fig. 126
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flange only
fig. 156, for ¾ to 12 in. pipe

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fig. 154
for ⅜ to ⅞ in. rod

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fig. 153
for ⅜ to ⅞ in. rod

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fig. 128
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fig. 116
for ¾ to 2 in. pipe
⅜ in. rod size

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⅛ to 2 in.

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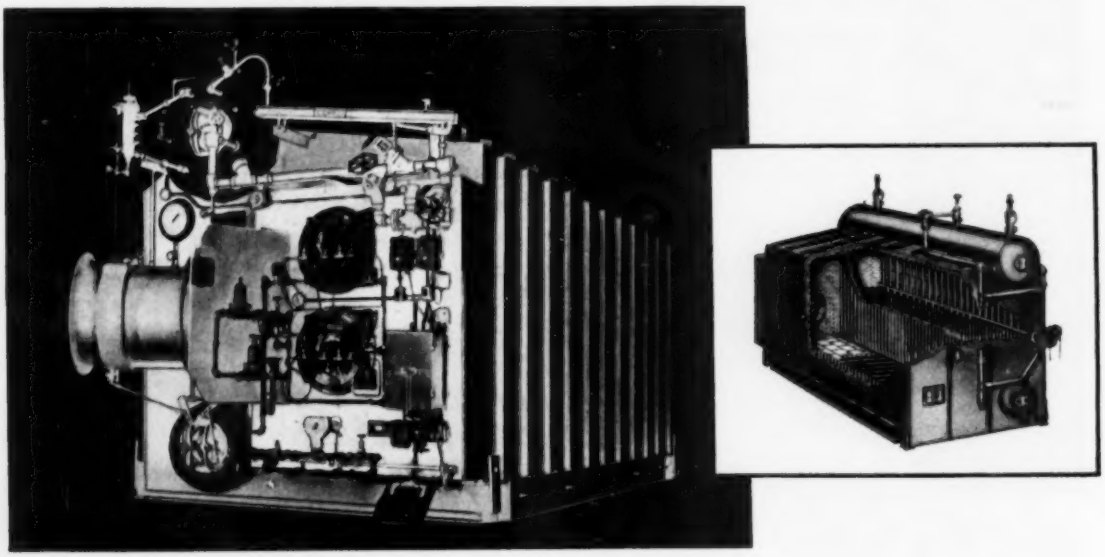
where you need it—when you need it

with the FW PACKAGE STEAM GENERATOR

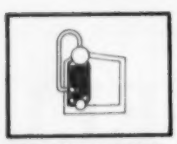


■ Foster Wheeler Package Steam Generators make it possible for you to have 7,500 to 35,000 lb of steam per hr depending on operating conditions. Standard designs for pressures of 250, 525, or 825 psi are available to meet your requirements for an economical source of steam "where you need it—when you need it."

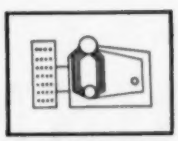
These plant-assembled, water-tube steam generators can easily be transported to your plant by common carrier, set on a simple foundation in a minimum space at the location best suited to your needs, and quickly put in operation after a few simple service connections. For small and medium-size plants a single unit will meet your needs for low-cost heating or process steam. Large plants have found multiple-unit installations to be the economical answer to their requirements up to 150,000 lb per hr.

For economy in installation, operation and maintenance, the Foster Wheeler Package Steam Generator offers a combination of features which incorporate many of the improvements and technical advancements of over 50 years of experience in steam generation. For more specific information write to Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

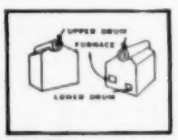
FEATURES THAT DISTINGUISH FOSTER WHEELER PACKAGE STEAM GENERATORS



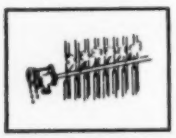
HIGH STEAM TEMPERATURES. Provisions for superheaters in some designs.



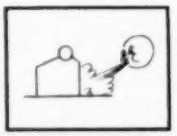
ECONOMIZERS. For larger capacity installations, package economizers can be supplied to provide minimum fuel costs.



ACCESSIBILITY. For inspection, cleaning, maintenance.



CLEAN HEATING SURFACES. Soot blowers incorporated . . . cleaning without boiler shutdown.



HEAT LOSS MINIMIZED. Minimum heat loss—from radiation and air infiltration.

RAPID LOAD SWINGS. Large diameter drums and ample furnace heating surface.

FOSTER WHEELER

Above: New power plant at Beloit, Kansas, has two new 2,100-hp dual-fuel units and two 1,080-hp units from the old plant.

Left: Mr. Ray G. Vollendorf, superintendent of Light and Water Department, did all the design work on the plant's large, modern switchboard.

STANDARD HD
TRADE MARK
OIL

New Beloit, Kansas, plant gets record low maintenance with...

● Acclaimed as one of the municipal showplaces of the Midwest, the new power plant at Beloit, Kansas, is going itself one better in actual performance.

The decision of Mr. Ray Vollendorf, plant superintendent, and city officials to switch to dual-fuel operation has paid dividends. Dual-fuel operation of the two new 2,100-hp units and a 1,080-hp converted unit has reduced fuel cost per kilowatt hour by more than 50%.

Another decision has brought its reward. To STANDARD HD Oil went the job of lubricating the plant's four diesels. Now, after nearly two years' operation, Mr. Vollendorf reports that crankcases are as clean as the day the diesels were placed in service. No rings or bearings have needed to be replaced. Visibility of tool marks on the rings and the over-all excellent condition of the engines indicate that many more hours of service are possible before any overhaul or replacement of parts will be required.

Including the two years' operation of the new plant, the experience of Beloit, Kansas, municipal officials with Standard Oil products covers 20 years. That experience testifies to the satisfaction and benefits you'll realize through Standard Oil's high quality products and outstanding service. You can reach the Standard lubrication specialist in your area of the Midwest by phoning your local Standard Oil office. Or, write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois.

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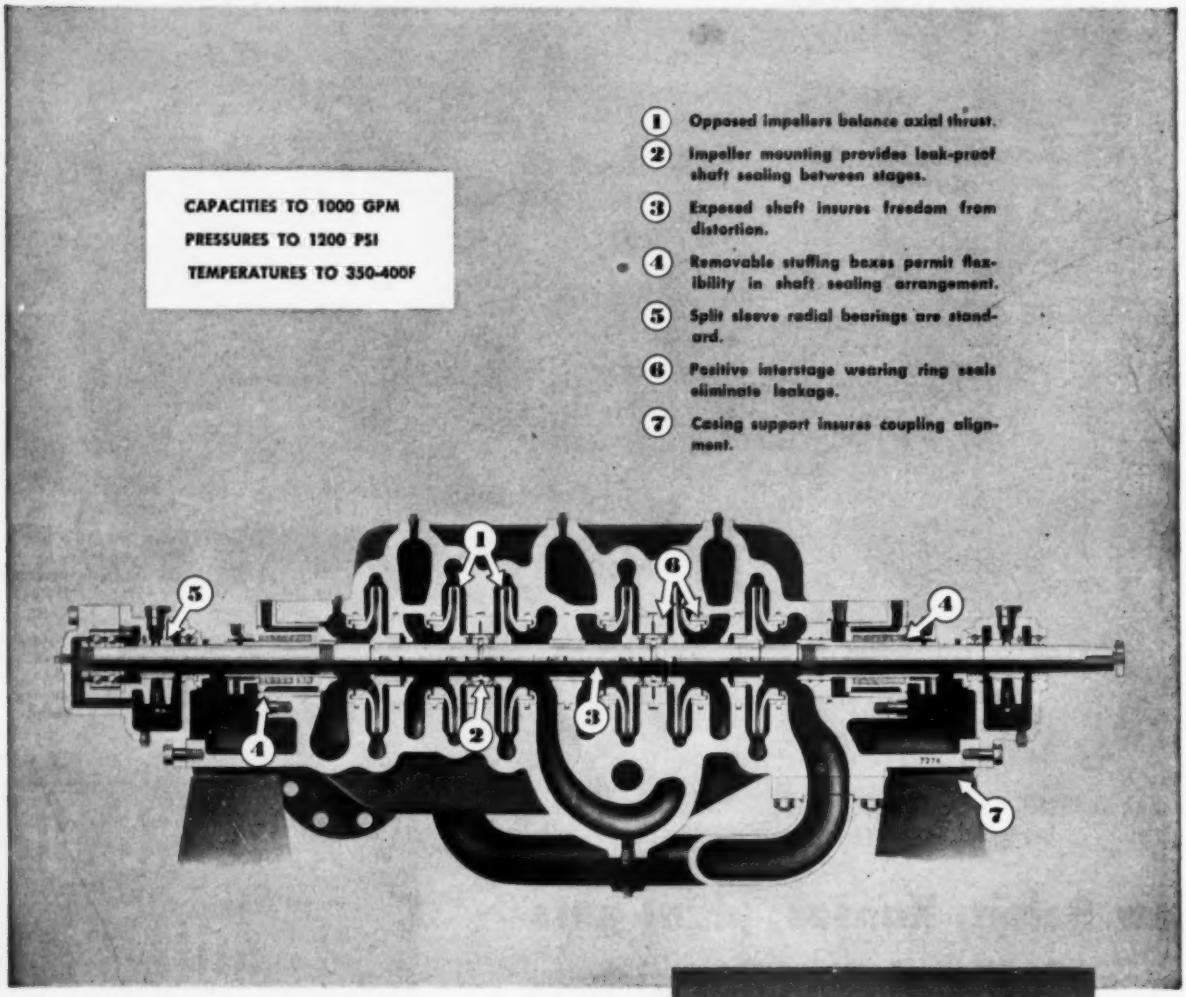
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Written by Joseph Harrington—one of America's foremost combustion engineers and authorities on Coal; its history, chemistry, properties, preparation; and efficient utilization, storing and handling.

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DARLING VALVES

INSIDE STORY...

on trouble-free valve performance

Install DARLING Revolving Disc GATE VALVES

Just what the doctor ordered . . . that's what users say about Darling fully revolving double disc, parallel seat gate valves. *Reason:* These unique valves adjust automatically to compensate for valve body distortion.

Moreover, Darling gate discs, independently hung from the upper wedge and free to revolve completely, change their seating position at each closing. This means uniform wear distribution. Valves work better and last longer, require less attention, less maintenance.

Wide Range Of Sizes And Types

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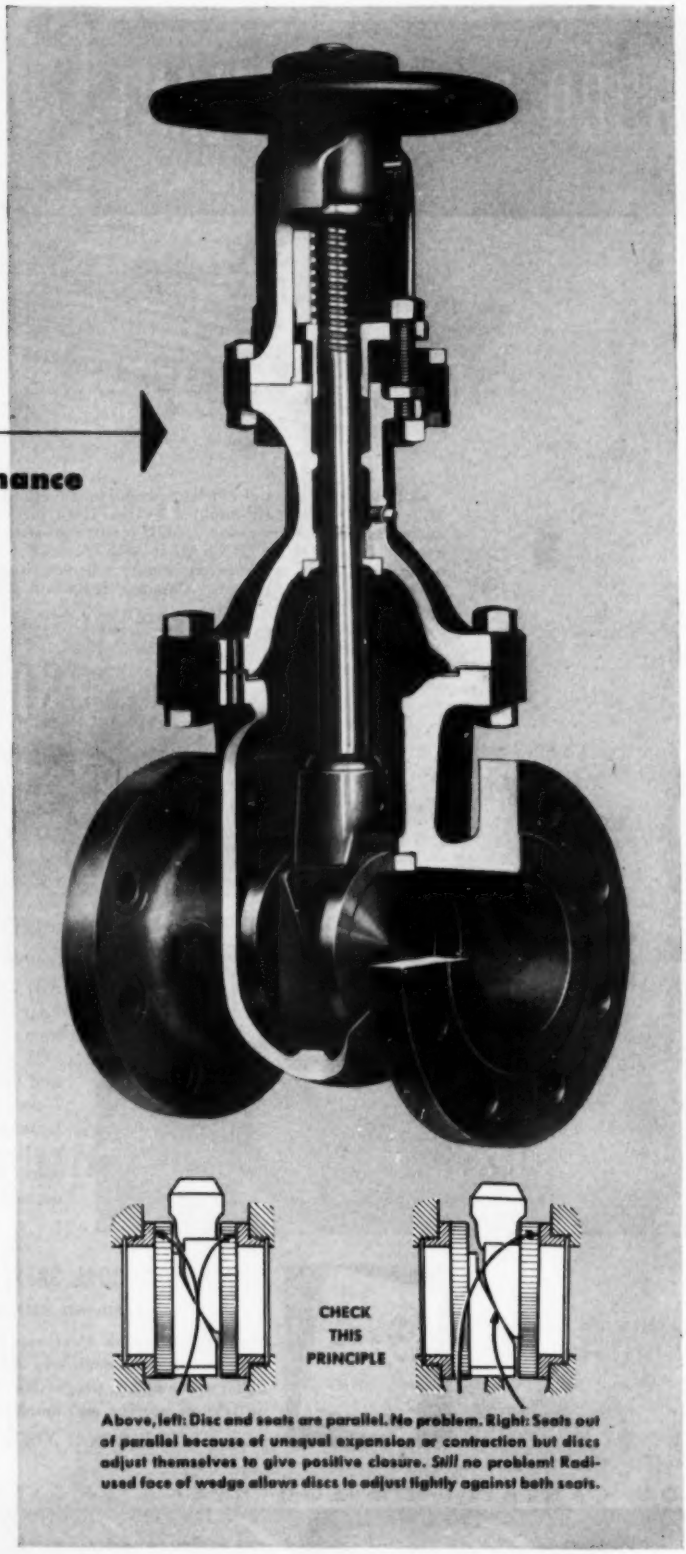

Above, left: Disc and seats are parallel. No problem. Right: Seats out of parallel because of unequal expansion or contraction but discs adjust themselves to give positive closure. Still no problem! Radiused face of wedge allows discs to adjust tightly against both seats.

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

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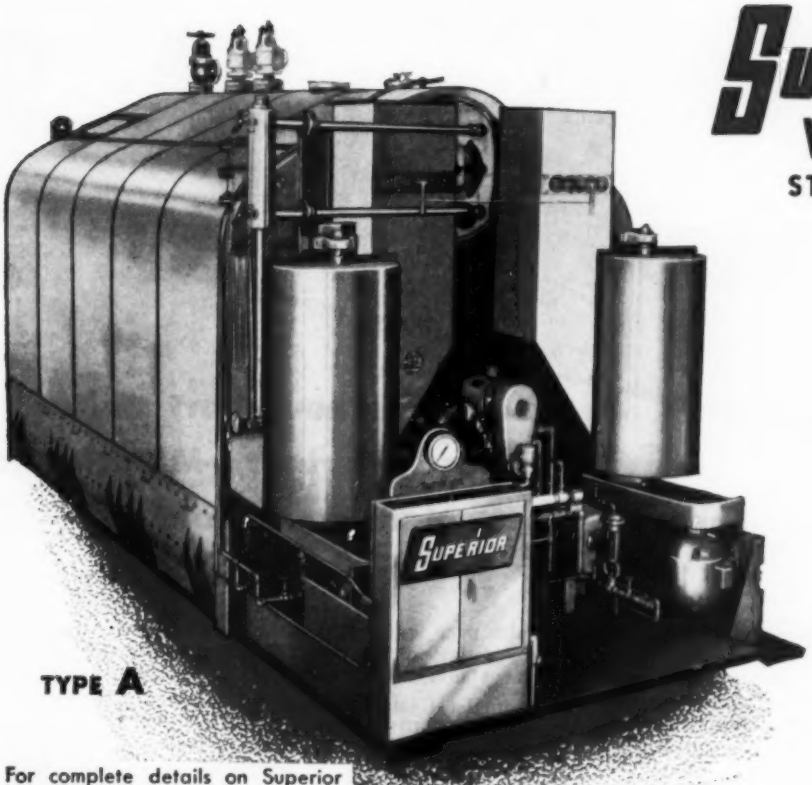
LBS. OF STEAM PER HOUR



TYPE **A**

For complete details on Superior Water-Tube Steam Generators write for illustrated catalog 502-W

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SUPERIOR STEAM GENERATORS

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Tips by Johns-Manville Engineers to help you keep production rolling

...and this new chart makes it easy to choose the right J-M Packings for your power plant equipment

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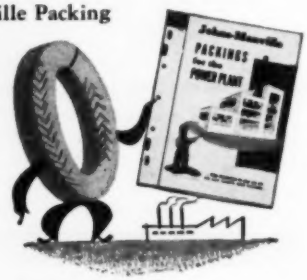
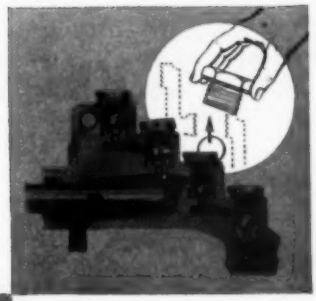
Its schematic diagram is spot-keyed to help you locate packing styles for various equipment units. Its brief group-headings help you select J-M packings for centrifugal and rotary services, reciprocating rods and plungers, valve stems, pipe flanges, manholes and handholes... to seal against steam, water, oil, brine, etc.... to withstand various temperatures and pressures. Its condensed packing descriptions give you essential buying information.

And a page is devoted to tips on proper installation to help you get maximum economy and efficiency from your Johns-Manville packings.

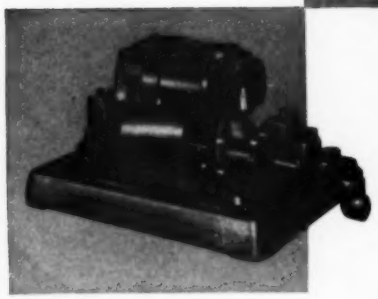
Your local Johns-Manville Packing Distributor will be glad to give you a copy of this handy packing selector, free of charge. Or write to Johns-Manville, Box 60, New York 16, N. Y., asking for Brochure PK-61A. In Canada, address 199 Bay Street, Toronto 1, Ontario.



Johns-Manville PACKINGS & GASKETS



Basic design simplicity of the exclusive Milton Roy liquid end step-valve assures high and reproducible volumetric efficiency. Inspection, servicing, or thorough cleaning of individual ball-checks and seats are effected without disturbing piping or other ball-checks and seats.



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INSTRUMENTATION

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Long service life is just one of many reasons why rugged Milton Roy Pumps are in wide use throughout industry. Wherever requirements call for precise metering of measured quantities of liquid in controlled volume, there's one of these versatile instruments to do the job. Capacity of each pump is variable from 0 to 100% by any one of several mechanical or automatic means of plunger stroke or speed adjustment.

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New Bulletin No. 553 *tells the complete story on Milton Roy Motor-Driven Controlled Volume Pumps and their application. Write for your* **free** *copy.*

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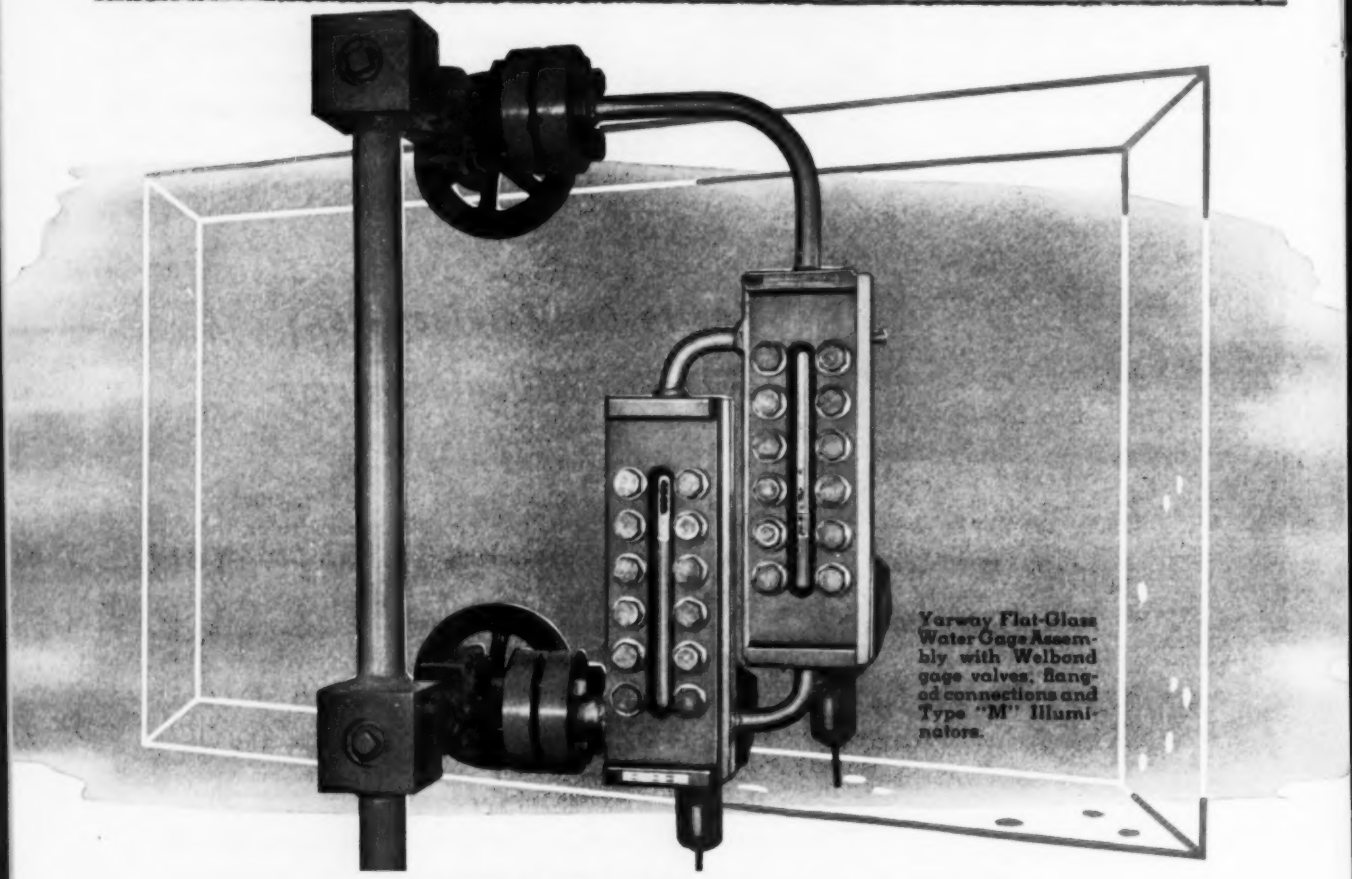
CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

What's New

IN BOILER WATER LEVEL INDICATION?



Yarway Flat-Glass Water Gage Assembly with Welbond gage valves, flanged connections and Type "M" Illuminators.

NEW *SEPARATED-DESIGN* WATER GAGES

This new Yarway water gage assembly has been developed to meet the demands for greater dependability, longer life, and more accurate readings in high pressure service.

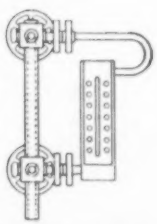
The gage glass inserts are of the Yarway pressure-sealed "floating assembly type". Yarway Welbond gage valves are used. Greater flexibility is gained by using two independent inserts, and by interconnecting expansion loops (see above).

The short connection to the drum assures greater accuracy of the gage reading, and the lower flanged connection eliminates a stuffing box. The upper flanged loop connection between the insert and gage valve allows expansion and contraction of the various components.

The tie bar-type water column linking the gage valves provides circulation to keep gage nearer drum temperature.

Yarway Type "M" Illuminators on the gage inserts cause the meniscus at water level to "shine like a star". This illuminator is especially effective in penetrating deposits on gage glass, dust particles in air and extraneous light.

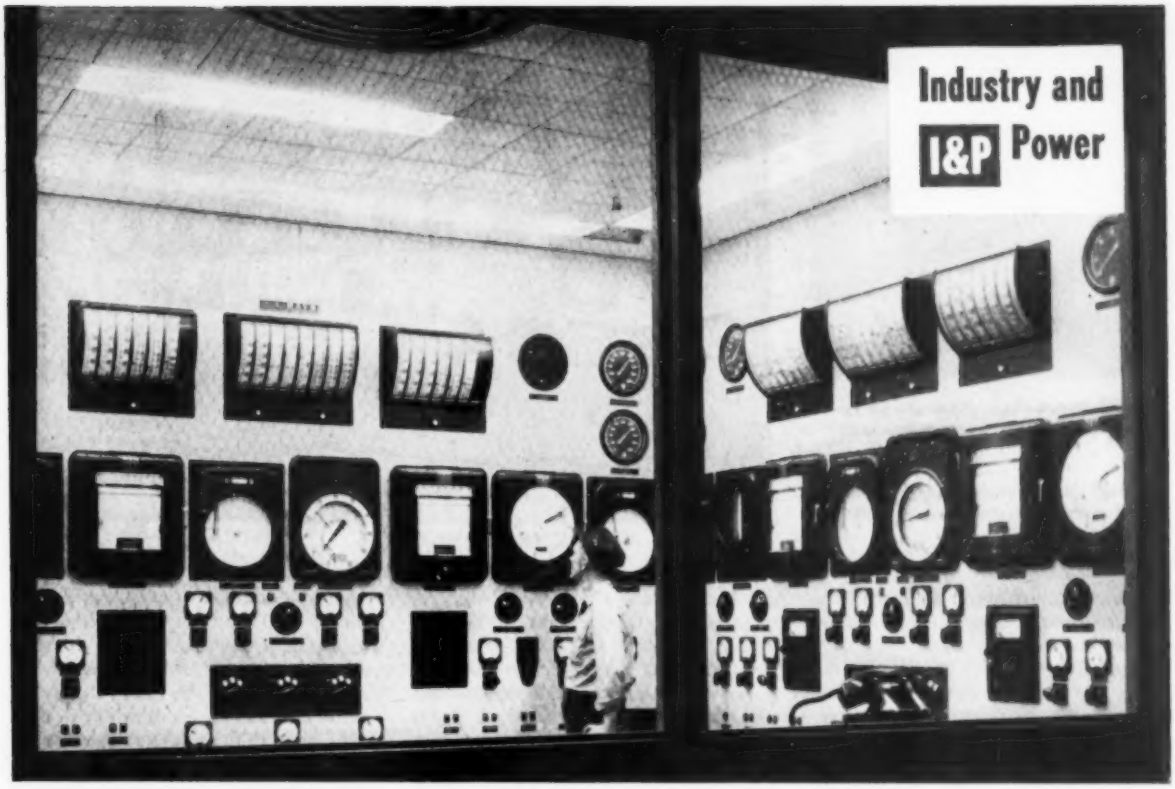
For full information, write for Yarway Bulletin WG-1811.



Yarway Single Insert type gage for medium range of visibilities.

YARNALL-WARING COMPANY • 109 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY STEAM PLANT EQUIPMENT



Consolidating automatic combustion controls with the boiler plant instrumentation simplifies operating procedures.

Combustion Controls For Multiple Fuel Firing

When using a combination of fuels and varying firing conditions, proper air to fuel ratio can be obtained only by the use of well designed combustion controls.

ORVAL W. RIGGS
Manager, Application Engineering
The Hays Corporation

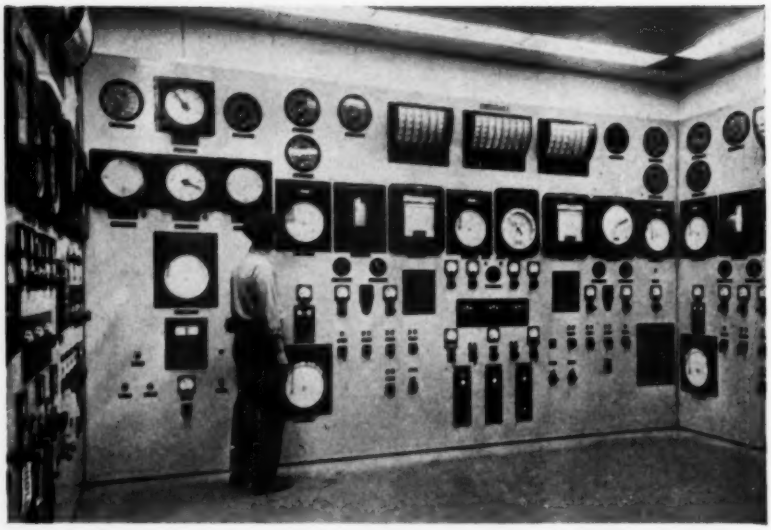
FOR MANY YEARS certain plants such as oil refineries, wood product plants, and steel mills have been burning by-product fuels either separately or in combination with coal, oil, or natural gas. In recent years this practice has spread to other industries and to central stations. The availability of a particular fuel and preferential rates on other fuels at specific times of the day, week, or year has made it economically desirable to burn two or three fuels either separately or in combination.

Automatically controlling multiple fuel fired units presents some interesting problems. Basically, control systems are designed to regulate steam pressure, fuel and air input, fuel-air ratio, and in the case of a boiler having an induced draft fan, the furnace draft. In most cases, the control of steam pressure and fuel input can be handled in the conventional fashion. However, properly proportioning air flow to total fuel flow under varying firing conditions introduces new problems.

Controlling Air Flow

In determining the total air flow required, it is possible to measure the flow of fuels to the boiler and to establish an air flow requirement for each fuel. If the air flow requirement for each fuel is known, the sum of the individual requirements can be obtained and total air flow established on that basis. This method is based on the assumption that it is possible to measure the flow of the individual fuels accurately and that fuel com-

Controllers in this plant are on the outer side of the control room wall.



Manual control stations and position indicators are inside control center.

position, pressure, and temperature do not vary enough to influence air flow requirements.

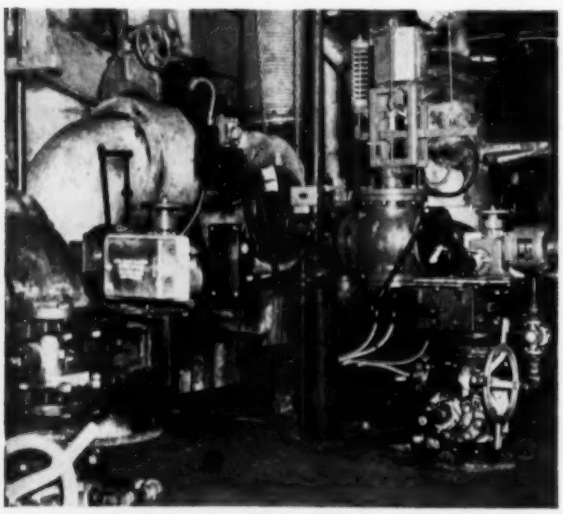
Another approach to the problem of controlling fuel-air ratio is to arbitrarily set the air flow controller from a master loading pressure and then correct the air flow on the basis of the air flow-steam flow relationship. In this case, the basic loading of the air flow element can be the sum of the individual loading impulses sent to the fuel control devices, or it can be adjusted manually for the number and types of fuels being fired. Air flow-steam flow compensation then provides the final air flow correction.

Systems of this type are based on the premise that a fixed quantity of air will produce a pound of steam regardless of the fuels being burned. It also is assumed that firing conditions and feedwater, fuel, and air temperatures will remain constant so that the Btu requirement per pound of steam does not change. Actually, the quantity of air required to liberate a fixed number of Btu varies substantially as the composition of the fuel changes. Generally speaking, less air is required per unit of heat release as the hydrogen content of fuel increases, assuming that only hydrogen and carbon are present in the fuel. If carbon monoxide is present, even less air is required for a given heat release.

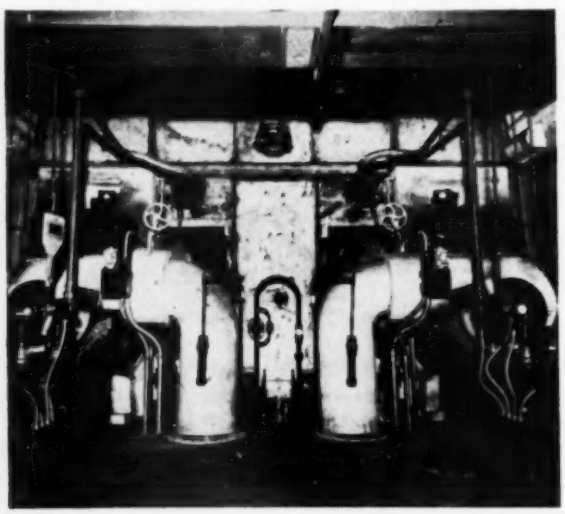
Since boiler efficiency drops off as the hydrogen content increases, it becomes necessary to provide more heat. This partially offsets the effect of the reduction in air requirement per Btu released as the hydrogen content increases. However, as some fuels require less air, if air flow-steam flow is to provide final air flow correction, some means of recalibrating or readjusting the instrument should be provided when fuel composition varies.

Excess Air

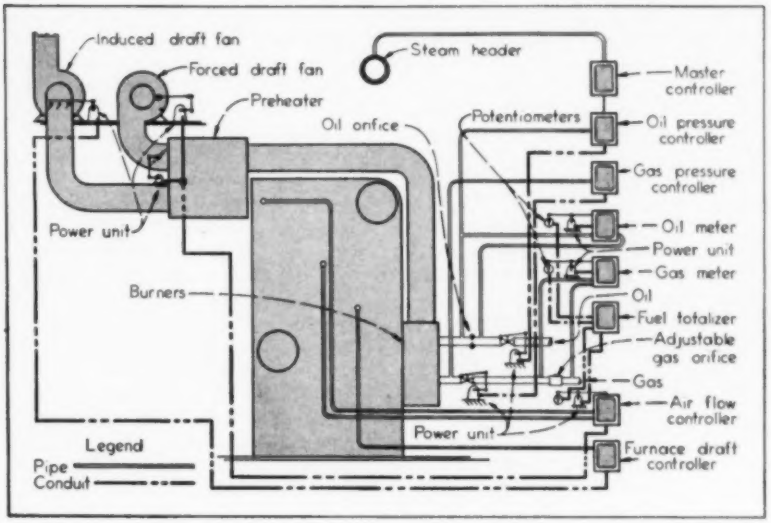
Another factor to be considered is the percentage of excess air. In some furnaces it will be necessary to carry more excess air with pulverized coal or oil than with gas. Readjustment of the air flow-steam flow compensation is possible but on a somewhat arbitrary



For gas firing, power units adjust butterfly valves in the individual gas lines in response to fuel totalizer.



Symmetrical front view of one steam generator shows secondary air ducts leading to two cyclone furnaces.



Correct furnace draft is maintained by controlling ID fan inlet dampers.

Fig. 1—Air flows for this system are based on measurements of fuel flows.

basis. On some pressurized furnaces, it may be desirable to operate with very little excess air. Precautions should be taken to prevent operating with an actual deficiency of air at any time.

Another system of air control being developed at the present time employs flue gas analysis to determine the proper fuel-air ratio. Both CO_2 and oxygen recorders are available. However, the ultimate CO_2 that can be obtained with any fuel depends upon the hydrogen-carbon ratio of the fuel. Pure carbon would produce the highest percentage of CO_2 while fuels high in hydrogen would produce relatively little. Consequently, CO_2 percentage would vary widely as the fuel composition varied. For that reason, CO_2 recorder readings would have to be interpreted on the basis of the fuels being burned.

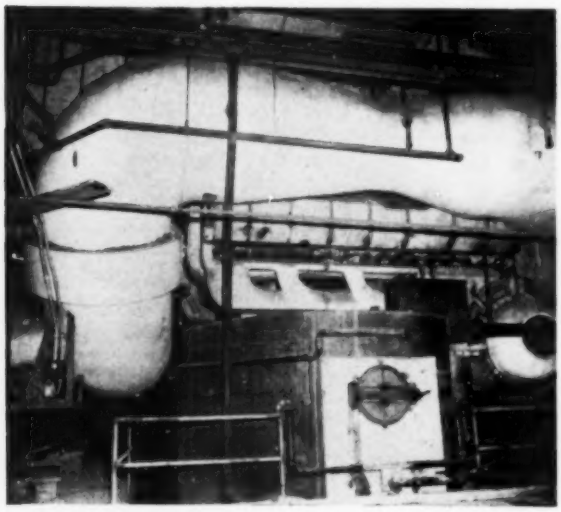
Oxygen recorders are the ideal combustion guide for multiple fuel firing. This is because the relationship between oxygen content of the flue gases and percentage of excess air remains essentially constant even though fuel composition may vary widely.

Control by Oxygen Measurement

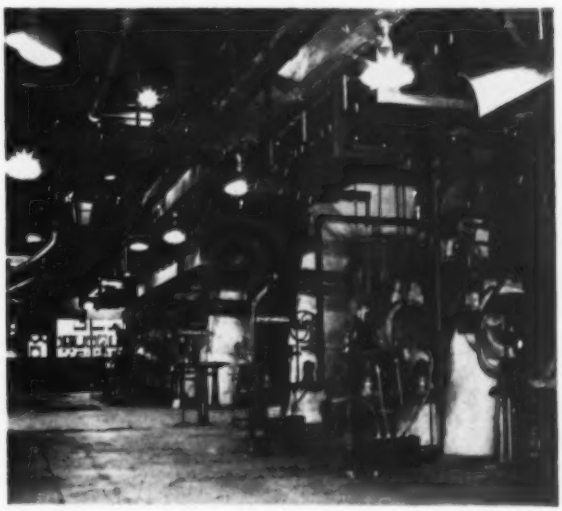
Considerable research has been done on control of fuel-air ratio from the measurement of oxygen in the flue gases, and a few installations of this type of control have been made to date and are operating satisfactorily.

Successful operation of this system depends upon a suitable gas sampling installation, a dependable oxygen analyzer and controller, and means for eliminating or compensating for the delay in the gas analyzing system. It is also necessary to provide some means for preloading of the air flow control mechanism from changes in fuel input. This arrangement provides immediate air flow adjustment when changes in fuel input occur, and the oxygen recorder-controller corrects air flow to the final value.

If extremely wide load ranges are being covered and if changes in excess air percentage are required for different fuels, some adjustment of the set point in the oxygen recorder-controller will be required. However, the



Power unit, left, operates damper in this forced draft duct. Huge venturi section is used to measure air flow.



Photograph of utility plant firing aisle illustrates proximity of control room to steam generating units.

oxygen recorder-controller reads directly in oxygen content or per cent excess air. Any adjustment of the set point can be made directly in terms of fuel-air ratio.

System Arrangements

One system of control in which air flow is proportioned to the sum of the individual fuel flows is shown in Fig. 1. A master controller of the proportional plus reset type adjusts oil and gas fuel controllers. These controllers actually measure fuel pressure at the burner and maintain the values that have been established by the master controller. These controllers are calibrated for minimum fuel pressure and at minimum loading will maintain these values independent of valve position, fuel pressure, or the number of burners in service. The two fuels can be adjusted simultaneously from the master controller, one fuel can be base loaded and the other controlled automatically, or the fuels may be fired separately.

Oil metering and gas metering controllers are provided. Each of these controllers actually measures fuel flow by measuring the differential pressure across an orifice in the fuel line. These controllers set up electrical values corresponding to the air flow requirement of the individual fuels. This same result can be obtained pneumatically.

These electrical values corresponding to the air requirements of the individual fuels are then fed into a fuel totalizer. Their sum is balanced against an electrical value corresponding to total air flow. Any difference between the sum of the individual requirements and the total air flow causes an unbalance in the totalizer. The totalizer in turn resets the air flow controller until the proper balance is established. In addition to resetting the air flow controller, the totalizer also resets the electrical value corresponding to total air flow to rebalance the circuit. Total air flow, therefore, is determined by the sum of the air flow requirements of the individual fuels.

The air flow controller measures total air flow by measuring the differential pressure across a portion of the air supply system. The most desirable arrangement is to measure air flow by taking the differential across a segmental orifice plate or a venturi section in the forced draft duct. Where this cannot be done, draft loss through the boiler or across some other portion of the system can be used. The air flow controller maintains the differential for which it has been set by controlling the forced draft fan damper. In this particular case, a combination of forced draft fan inlet vanes and outlet damper is used. The inlet vanes are controlled to the limit of their effectiveness, and then the control is transferred automatically to the discharge damper. A furnace draft controller maintains proper furnace conditions by controlling the induced draft fan damper. If the furnace were pressurized, the furnace draft controller would be omitted.

Only the basic controllers are shown in Fig. 1. Additional controllers for limiting the load to the available induced draft or limiting the fuel input to the available air supply can be provided. Time delay relays and fuel shutoff valves also can be added. Remote manual controls for each element of the system and for adjustment of fuel-air ratio are in the control room.

Fig. 2 shows a system of control in which a measurement of oxygen in the flue gas is used to establish the proper rate of air flow. Control of gas and oil flow is essentially the same as the system shown in Fig. 1. However, no measurements of fuel flow or air flow are involved in this system.

Stabilizing or preloading pistons are mounted on the oil valve and gas valve power units. With movement of either or both of these valves, impulses are transmitted to the oxygen recorder-controller. These impulses produce an immediate change in the set point of the oxygen recorder-controller and initiate some change in air flow even though the oxygen content of the flue gases may not have changed. If oxygen analysis determines that the final fuel-air ratio has not been obtained, the oxygen recorder-controller makes the final correction of air flow by adjusting the damper.

The oxygen recorder-controller regulates a combination of forced draft fan turbine speed and damper position to arrive at the proper air flow. Under normal operating conditions, fan speed alone is controlled with the damper in the open position. At light loads, the fan speed is reduced to a predetermined minimum, and then the control is transferred automatically to the fan damper to obtain proper regulation. The furnace draft controller controls a combination of induced draft fan speed and damper position.

In addition to the basic control system, a load limiting controller is provided which measures furnace draft. If a reduction in induced draft produces a tendency toward positive furnace pressure, this controller acts to limit the fuel and air input to a value that can be handled safely with the available induced draft. A time delay relay is provided to shut off the fuel control valves if proper furnace conditions cannot be reestablished within a definite time limit.

Complete remote manual control with provisions for fuel-air ratio adjustment is included with the system. Safety features include a gas pressure switch which is tied into the control circuit and a diaphragm trip type gas shutoff valve with manual reset. A solenoid operated vent valve relieves the pressure on the diaphragm to trip the shutoff valve. Similar safety equipment can be provided for oil firing.

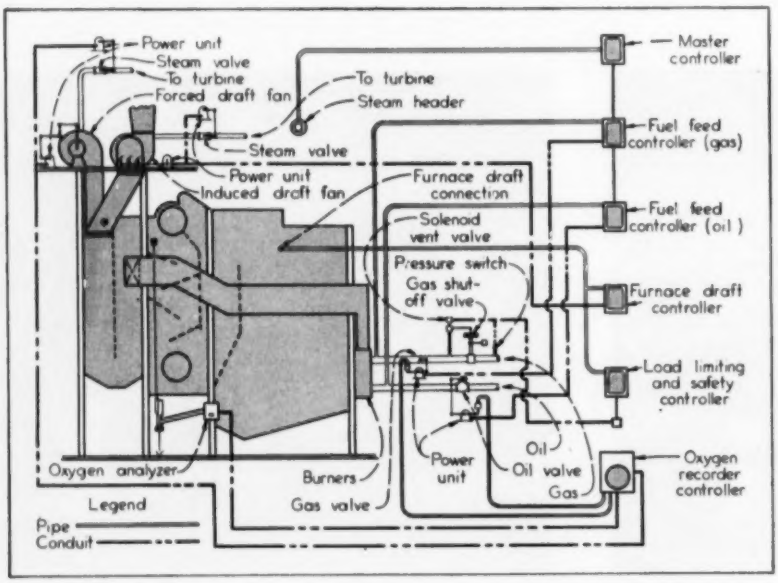
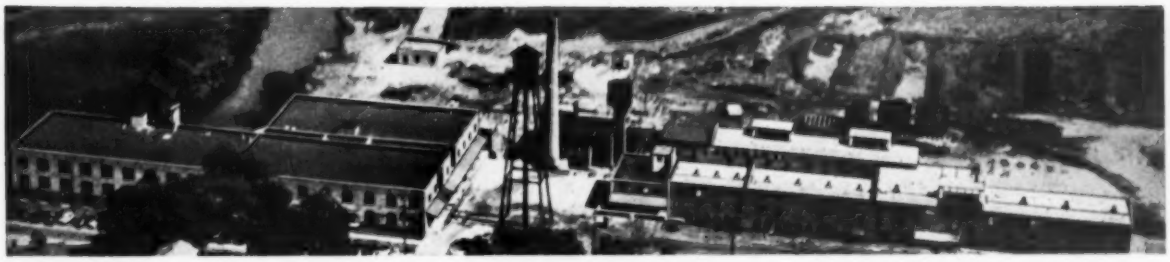


Fig. 2—Schematic drawing shows a system of control which uses a measurement of oxygen in the flue gas for establishing the proper primary air flow rate.

a special report...



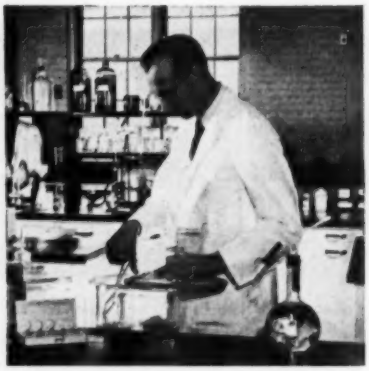
This purchased plant in Holland, Michigan was converted by Parke-Davis to chloromycetin production in nine months.

Parke-Davis Engineers Convert Holland Plant

- Introduction
- Power Plant
- Electrical System
- Waste Disposal
- Tank Farm
- Well Water Supply

CONTRIBUTORS to Parke-Davis' highly successful conversion of an existing plant in Holland, Michigan to the production of chloromycetin (left to right): D. G. Neill, project coordinator; D. K. Foraker, superintendent of engineering; E. E. Middleton, purchasing agent; H. H. Hunt, assistant superintendent of engineering; L. Dahnke, chief draftsman; J. Adinoff, senior chemical engineer; G. Breisch, department manager, mechanical engineering; L. Plath, consulting engineer; N. P. Kenyon, senior engineer, instruments and controls; and C. W. Lintner, department manager, chemical engineering.

Donald J. Vink is superintendent of Parke-Davis' Holland plant.



The laboratory is the control room in pharmaceutical processing.

Winthrop F. Roser manages chemical manufacturing at Holland.

Introduction

D. K. FORAKER

Superintendent of Engineering

PARKE, DAVIS & COMPANY — manufacturers of over 1000 pharmaceutical products — developed and synthesized chloromycetin in their laboratories. It is the only antibiotic which chemists have been able to build up synthetically.

When chloromycetin's effectiveness in combating over 100 different diseases and pathogenic bacteria became known, Parke-Davis soon found it necessary to double its production facilities for this drug. In its desire to decentralize without going too far afield and to get additional chloromycetin production going as soon as possible, expansion of existing plants and new construction were ruled out. Then, several existing plant properties in Ohio and Michigan were considered. The vacant Armour Leather Company plant at Holland, Michigan was finally selected.

Several objectives were considered to be of great importance in selecting this new site. Uppermost was water supply for processing. Further, electrical power rates were investigated thoroughly, and the Holland area was found satisfactory. In addition, the Holland area had an adequate labor supply in numbers and in levels of skill. The Armour property also contained sufficient acreage to permit any further expansion when necessary.

Transportation requirements were met by excellent rail and highway facilities. Equally important, raw materials for the production of chloromycetin are found close to the new plant.

The chemical engineering department worked with production, pilot plant, and research departments in designing the processing system. The chemical engineering department was also responsible for ordering and installing the new production equipment and for redesigning the water and waste disposal system.

The electrical engineers surveyed the existing electrical facilities to see how they could be adapted. After thorough consideration, the entire existing system was removed and junked. By this time, the chemical engineers had formulated their process lines, decided where equipment was to be

Packaging machinery for handling pharmaceutical bottles is extremely important, insuring the protection appropriate for life-saving drugs.

placed, and had nearly completed the plant layout.

The electrical department was then armed with the data necessary to select the proper system. Motor loads were calculated and the electrical department worked out a new wiring system for all processing, lighting, ventilation, and power plant apparatus.

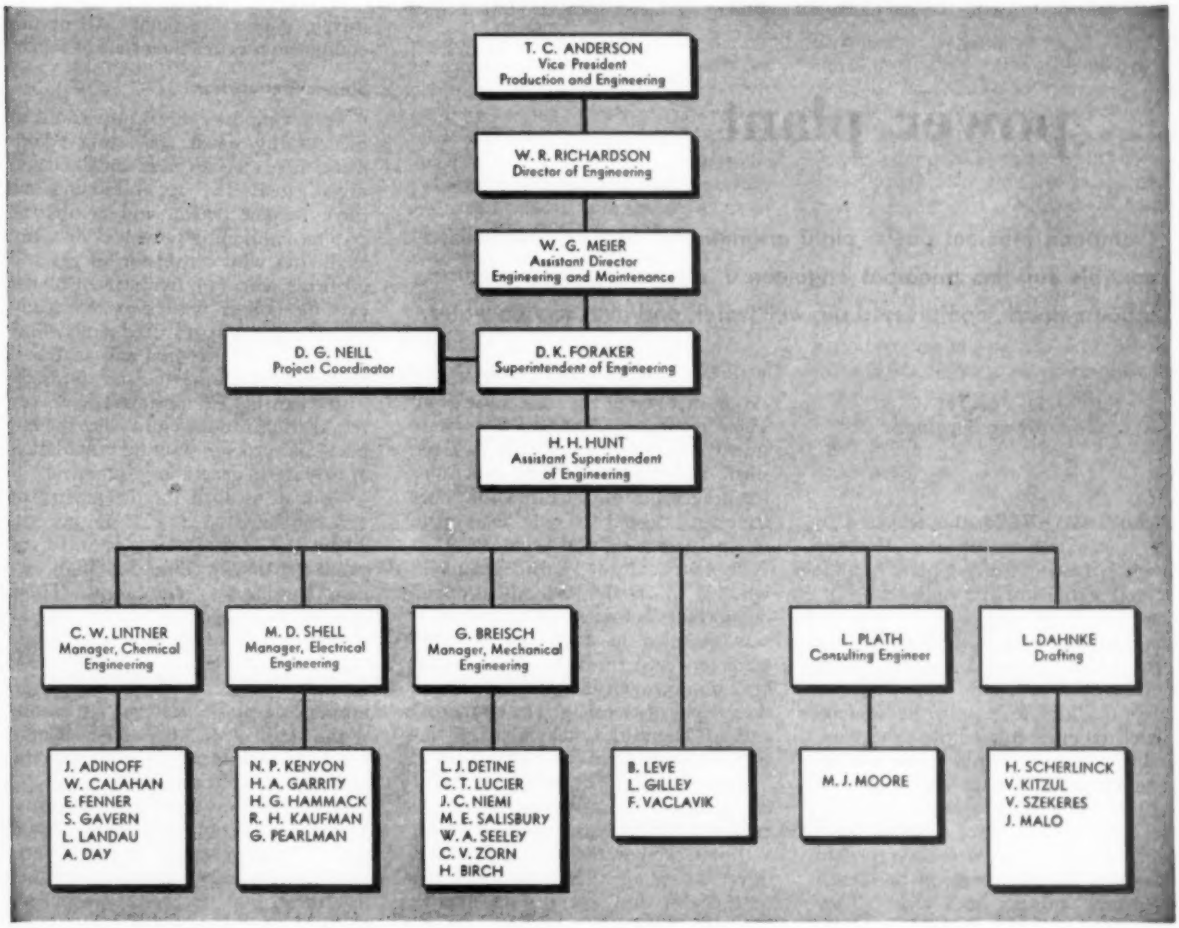
Design of the power plant's water treatment system was the responsibility of the power plant department. The chemical engineering department established the steam load for processing and heating. From these data, decisions were made for a multiple installation.

The responsibility of the mechanical engineering department included layout of the general plant, maintenance shops, offices, air conditioning and ice systems, laboratories, store rooms, and outside parking areas.

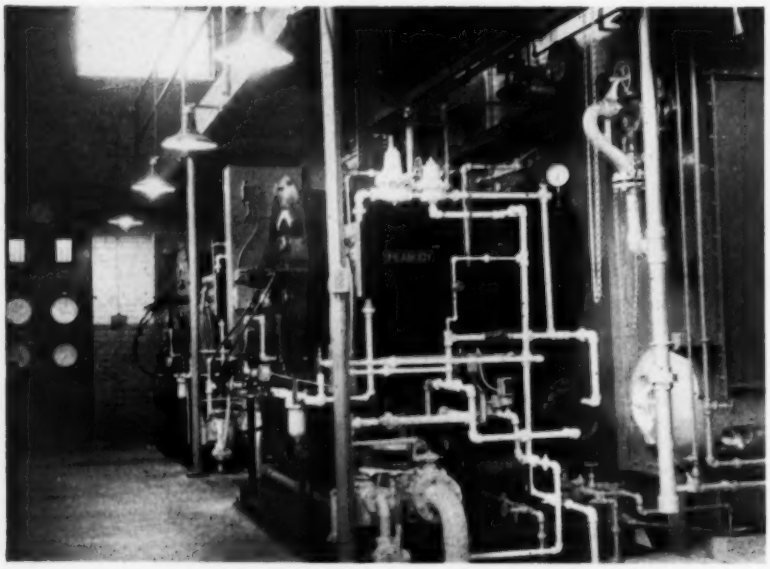
Correlating all these design recommendations and submitting them to the architects was the duty of the drafting department. A liaison engineer was responsible for the cooperation between the architect and the construction contractors. Further, it was his duty to see that materials of construction and processing equipment were on hand so that the plant rehabilitation could proceed on schedule.

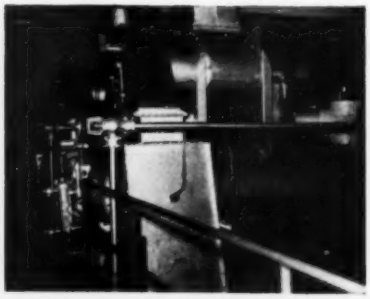
Each of these departmental functions was so well coordinated with all the others that in nine months the Armour Leather Company plant was converted to the production of Parke-Davis chloromycetin and production was underway.

Mixing and batching are among the many exacting plant processes in the synthesizing of chloromycetin.



This staff represents the many who contribute to the efforts of Parke-Davis to meet the increasing demand for chloromycetin. The demand developed soon after the effectiveness of this new wonder drug became known.





One induced draft fan is mounted on top of each package steam generator.

Firing equipment, forced draft fans, and controls are readily accessible.

. . . power plant

Compact, efficient power plant arrangement features centralized controls for the principal engineered service systems: electric, process steam, compressed air, well water, and river service water.

L. PLATH
Consulting Engineer

SHORTLY AFTER the selection by management of the Holland, Michigan manufacturing plant site, the several sections of the engineering department were delegated to examine the premises and start work on the project. This included a survey on the development of steam, water, and related facilities to supply the contemplated requirements of the new plant.

Inspection of the old boiler and engine room revealed the following conditions. The steam generating facilities consisted of three vertical water tube boilers which were in very bad condition. Furnaces were of the Dutch oven type with fire brick arches. They were fitted with side feed stokers. Both stokers and drives were in poor condition. No automatic controls existed except that two of the boilers had feedwater regulators. All feed lines were scaled, and the old water heater was too small and did not include provisions for deaeration. No facilities for water treatment existed as only inadequate internal treatment had been used.

Coal was unloaded outside the plant, wheeled to an elevator, and dropped down chutes before each Dutch oven. It was shoveled in as required. Ashes were conveyed through a hydro-steam system into an outside elevated silo and then removed by trucks. The entire coal and ash handling system was very unsightly and required considerable labor.

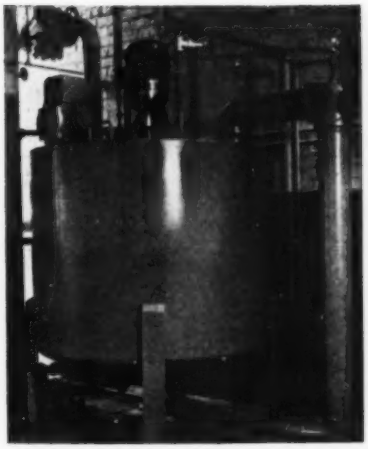
Engine room equipment included two noncondensing steam engine generators, a noncondensing steam turbine, a triplex well water pump, a vertical direct acting air compressor mounted on the wall, and several steam pumps for boiler feed and condensate return. A pit outside the engine room contained a 1000-gpm, Underwriters, steam driven, duplex fire pump. All of this equipment was in a poor state of repair.

Steam Generation

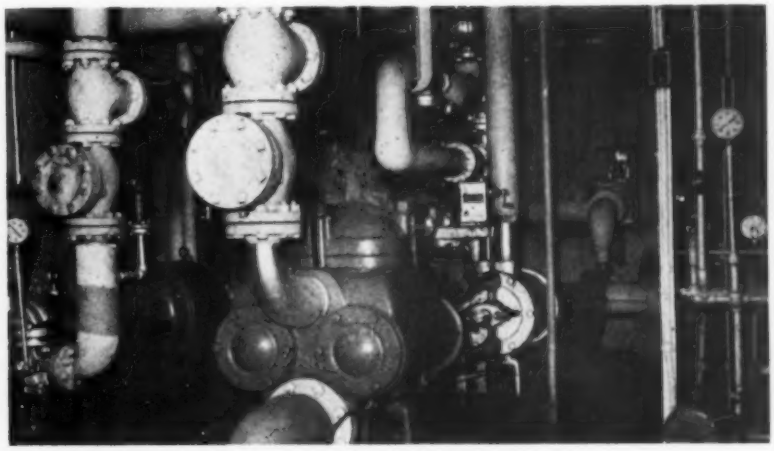
Following the general inspections of the existing steam generating equipment, three schemes were suggested and investigated: (a) reconditioning the three present boilers and auxiliaries, (b) reconditioning present boilers and auxiliaries with conversion to gas and oil firing, and (c) replacement of the existing boilers with two new combination gas and oil fired units. Cost estimates were prepared and analyzed, bearing in mind the age and condition of the existing equipment. This survey resulted in the decision to scrap the old plant and proceed with the installation of new steam generating equipment.

Peak steam load for the new plant was estimated at 25,000 lb per hr. About 1/6 of this total is required for steam ejectors which produce high vacuum for process equipment. These ejectors were specified for 100 psig at the inlet as failure due to pressure drops below the design point could cause product spoilage. In order to provide insurance against pressure fluctuations at the steam generators and overcome frictional resistances of the piping, the pressure was selected at 140 psig.

Since time was an important factor, it was decided to use a prefabricated type of steam generator on this project. While preliminary floor plans revealed that three, 300 hp, "A" type boilers could be accommodated in the existing boiler room, only two units were included in the initial installation. These



This mixing tank supplies lime-soda for the hot process softening system.



Plant has two boiler feedwater pumps, a motor driven centrifugal for normal operations and a steam driven duplex for light loads and emergency service.

boilers are "A" type, three drum, bent tube, package steam generators, each complete with brickwork, steel casing, feedwater regulator, soot blowers, blowdown valves, water column, continuous blowdown skimmer in drum, safety valves, induced draft fan with control and stub stack, and prefabricated interconnecting piping.

Coal firing was ruled out because of the fly ash nuisance and handling problems. Thus, combination gas and No. 6 oil burners of the modulating type, were selected. Auxiliary equipment includes a complete fuel oil pumping and preheating system, constant differential mechanical atomizing fuel nozzles, gas-electric ignition, electronic flame failure protection, solenoid fuel oil shutoff switch, steam pressure limit switch, gas pressure cutout switch, low fuel oil temperature cutout switch, and low fire start after each burner shutdown. Air and fuel are synchronized and proportioned from minimum to maximum fire. Furnace draft is controlled automatically by modulation of an uptake damper in the ID fan suction duct.

Boiler Feed Pumps

To insure reliability and flexibility, the engineers decided both electric driven and steam driven boiler feed pumps should be available. One of the old steam driven duplex pumps seemed to be in fairly good repair and was reconditioned and fitted with a differential pressure throttle governor so it could be used for emergencies and at light loads. For normal operation a new, centrifugal, three stage, motor driven pump was selected having a capacity of 120 gpm at 5-psig suction and 205-psig discharge pressure with a water temperature of 228 F. This unit supplies the water required for peak operation of both boilers, and has worked out very well up to the present time. If load conditions should necessitate the addition of a third boiler, another boiler feed pump will be installed to assure reliable operation.

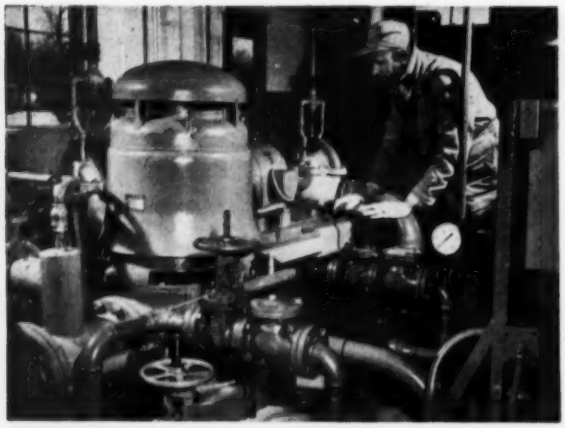
Since the automatic modulating type burners are responsive to steam pres-

TABLE 1—COMPOSITION OF AVAILABLE RAW WATERS

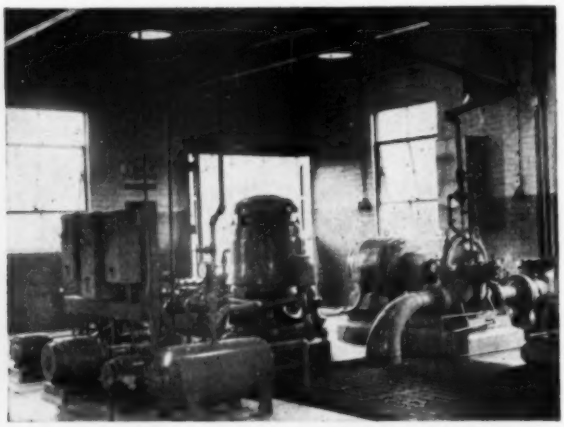
	Well water	River water
Total hardness, ppm as $CaCO_3$	122	141
Total alkalinity, ppm as $CaCO_3$	100	135
Phenolphthalein alkalinity, ppm as $CaCO_3$	0	0
Free CO_2, ppm as $CaCO_3$	0	10
Non CO_3 hardness, ppm as $CaCO_3$	22	6
Calcium, ppm as $CaCO_3$	94	112
Magnesium, ppm as $CaCO_3$	28	29
Sodium, ppm as $CaCO_3$	11	51
Sulfate, ppm as $CaCO_3$	28	36
Chloride, ppm as $CaCO_3$	4	21
Nitrate, ppm as $CaCO_3$	1	0
Iron, ppm as Fe	2	1
Silica, ppm as SiO_2	9	1
Turbidity, ppm as SiO_2	16.3	0
Total solids	154	262
pH	7.1	7.4

TABLE 2—ANTICIPATED COMPOSITION OF TREATED WATER

	Parts per million as $CaCO_3$		
	Raw well water	H-Z-Na Z	Hot lime-soda
Calcium + +	94	1	14
Magnesium + +	28	1	6
Sodium +	11	46	58
Hydrogen +	0	0	0
Total cations	133	48	78
Bicarbonate —	100	15	0
Carbonate — —	0	0	45
Hydroxide —	0	0	0
Phosphate — — —	0	0	0
Chloride —	4	4	4
Sulfate — —	28	28	28
Nitrate —	1	1	1
Total anions	133	48	78
Total hardness	122	2	20



Two centrifugal pumps (partially obscured by vertical fire pump in center) supply river water for the plant.



Two of the pumps at left are fire system leakage pumps and the third is the service water system priming pump.

sure changes, it was not necessary to incorporate boiler control in the metering equipment. However, steam flow — air flow meters were purchased for each boiler, so combustion efficiency and output can be readily observed. The meters are mounted on the boiler control panel, which also includes individual three element draft gages for each unit and recording pressure gages for the main steam header and feed lines.

Both well water and river water were available at the plant site and preliminary samples of each were analyzed to determine their respective suitability for boiler feed. The results of these tests (as shown in Table 1) and the fact that the well water was more constant in composition, indicated that the best arrangement was to use well water for normal boiler feed. Provisions were incorporated for using river water in emergencies.

Feedwater Treatment

Two systems of raw feedwater treatment were considered. One was a combination hydrogen and sodium softener with blending control, degasifier, and deaerating heater. The other method investigated was a hot lime-soda softener with provisions for deaeration of both makeup water and condensate. Anticipated effluent composition from both these systems was calculated and compared, as shown in Table 2.

Various factors influenced the selection of the treatment method. First, an alkaline softening plant waste was preferred for integration with the type of waste disposal being considered. Second, handling acid is always dangerous, depending on the class of labor available and the extent to which safe methods of handling are employed. Third, although no thermal advantage could be gained by incorporating a heater in the hydrogen-sodium cycle, there being little by-product or exhaust steam available, it was deemed advisable to preheat the boiler feed to avoid cold water shock and to remove dissolved gases. The chemical quantities required to treat 1,000,000 gallons of water and the respective costs of these chemicals are shown in Table 3.

Equipment cost estimates also were prepared for both systems and proved in favor of the hot lime-soda method if a heater were included with the hydrogen-sodium softener. Therefore, a hot lime-soda system was selected, capable of softening, deaerating, and heating 2400 gph of raw water; deaerating and heating 7200 gph of condensate; and providing 7½ minute storage capacity.

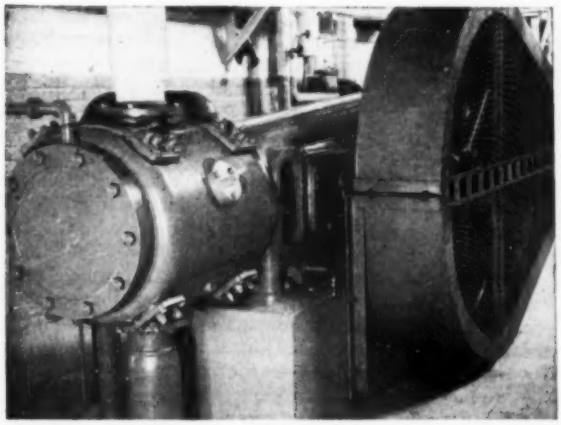
In addition to this external treatment, provisions were made for supplementary internal treatment to insure the best possible protection. The system includes: (a) a dual proportioning pump, one unit for each boiler, with chemical mixing tank for pumping anhydrous disodium phosphate directly into each boiler, and (b) a single unit proportioning pump with chemical mixing tank to pump sodium sulfite and organic sludge conditioner into the boiler feed lines to be distributed to the two boilers in proportion to the load carried by each.

Chemical tests are performed by the operating engineers, subject to advice and control standards established in a water consulting laboratory. Operating experience of over 18 months and periodic examination of the boilers indicate highly satisfactory results.

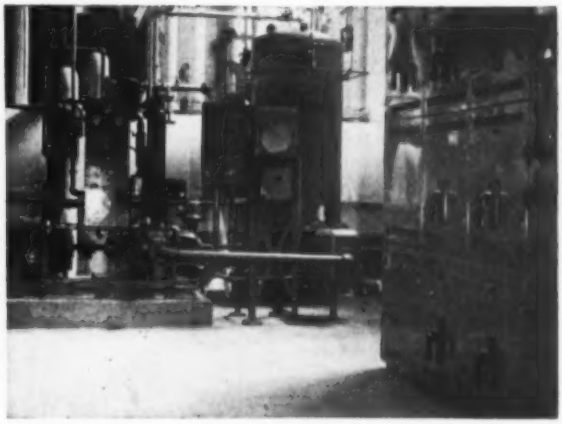
Provision is made for returning condensate from all the buildings to a vented receiver. Separate return lines with sample connections in each are used so contamination can be detected and the

TABLE 3—COSTS OF TREATING 1,000,000 GALLONS OF WATER

	← Na_2Z - H_2Z →			← Hot Lime-Soda →		
Chemical	Quantity lb	Unit cost ¢ per lb	Total cost dollars	Quantity lb	Unit cost ¢ per lb	Total cost dollars
H_2SO_4	161	3	4.83	—	—	—
NaCl	133	1	1.33	—	—	—
$Ca(OH)_2$	—	—	—	96	2	1.92
Na_2CO_3	—	—	—	48	1.5	.72
$NaHPO_4$	6	8	.48	22	8	1.76
Total cost			$6.64			$4.40



Compressed air for process equipment is supplied by a piston type, single stage, double acting air compressor.



Air compressor and dryer at left are for instruments and controls. Panel at right contains primary breakers.

source determined. Boiler feed pumps are arranged to give preference to condensate, and additional makeup water is automatically drawn from the treated storage compartment of the hot process softener whenever condensate is insufficient to supply boiler demand. One set of dual booster pumps provides sufficient pressure to pump raw water into the treated water section of the softener through a spray heater, vent condenser, and meters. Another set of dual booster pumps provides pressure to pump condensate into the condensate section of the softener through a spray heater.

Steam Distribution

Four steam pressure standards were required for plant operations. The boilers operate at 140 psig, and steam at this pressure is used for the boiler feed pump, fire pump, fuel oil heaters on the boilers, and to supply three pressure reducing stations connected to the main header. One of these stations reduces the pressure to 110 psig for the steam ejectors, recovery equipment, and certain process equipment. The second supplies 40-psig steam for process equipment, space heaters, and evaporators, while the final reducing station furnishes 5-psig steam for the hot process softener and heating.

Although only two boilers are now installed, the high pressure header was run the full building length and has a blank flange for the future boiler. Two sectional valves are installed, one on each side of the take-off from the centrally located boiler, but no emergency loop was constructed at this time. The three pressure reducing stations are each supplied from separate sections of this header to provide insurance against total shutdown.

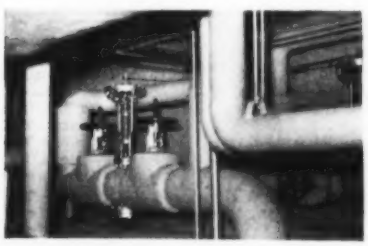
Pressure reducing valves are of the air operated diaphragm type with three valve bypasses for emergency use. The air operated controls are mounted on a panel in the engine room and are provided with setback and reset features. All three reduced pressure headers are side by side in the same horizontal plane in the engine room, and they are provided with safety relief valves. These safety valves have sufficient capacity to provide protection even if the reducing valves should fail while in the full open position.

Compressed Air

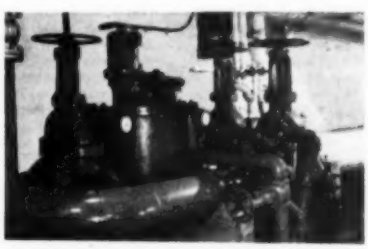
Compressed air for air tools, air driven stirrers, and other process equipment is supplied from a motor driven, piston type, single stage, double acting air compressor equipped with V-belt drive and water cooled aftercooler. This unit has an actual delivery capacity of 221 cfm at 100 psig, which is ample for general plant service. However, because of the nature of the process requirements, compressed air for instrumentation and control was given extensive consideration. The problem of supplying clean, dry air, absolutely free from oil could not be solved satisfactorily with separators or filters. This resulted in the installation of a separate instrument compressor.

Two basic types of compressors were considered for this purpose. The first was the carbon ring type, which did not require oil to lubricate piston and cylinder walls but did necessitate the use of an aftercooler and dryer. The second was the rotor bucket water piston type requiring seal water. It is somewhat less efficient mechanically than the carbon ring type. This unit also required an air dryer to reduce moisture to design limits.

Careful analysis led to the final selection of a water piston type com-



Pressure reducing stations provide process steam at 110, 40, and 5 psig.



All service water is pumped through an automatic self cleaning strainer.

pressor. This decision was influenced by several factors. Initial cost and maintenance were lower although the operating power demand was higher. The unit provides dust free air, which is cooled to the temperature of sealing water thereby decreasing the load on the air dryer. No aftercoolers, filters, or oil traps are required, and the compressor can be installed in less space.

A silica gel, dual unit air dryer was employed to remove moisture down to minus 30 F dew point when the compressor is supplied with water at 70 F. This unit has a capacity of 40 cfm at 50 psig and is installed in the instrument air line to the manufacturing building and the tank farm for protection against freezing due to moisture in the air. The instrument air compressor has a capacity of 125 cfm at 50 psig and supplies all instrument air for the plant. An emergency connection from the general service air compressor is provided as an emergency precaution.

River Water System

When cooling water requirements of the plant were estimated it was decided to use well water wherever water enters the product or cooler inlet water temperature was necessary for the process, and river water for all other services. The estimated river water demand for heat exchangers, refrigeration condensers, barometric condensers, and other apparatus where water does not enter the product was about 1200 gpm. For these services, a maximum temperature of 75 F is adequate.

River water was available from the Black River, the shoreline of which was about 650 ft south of the power plant. A small creek flowing into this river also existed with its shoreline about 250 ft east of the power plant. Because of soil conditions, it was decided to build an intake and pump house along the shore of this creek, rather than along the river bank.

This building is 39 ft long x 29 ft wide with a centrally located well pit 20½ ft long x 6 ft wide. River water enters this pit through a 48 in. conduit from the intake crib at the creek bank. A removable trash rack prevents large debris from entering this conduit, and the well pit is protected from entrance of small debris by a traveling water screen 5 ft wide. Screen panels are fitted with 4 mesh, No. 14 gage, galvanized wire cloth.

All circulating water pumps are located around the periphery of this pit. These include: two 1200-gpm centrifugal pumps for general service, one 1500-gpm turbine type vertical fire pump, and two centrifugal fire system leakage pumps, of 50 and 100-gpm capacity, to maintain nominal pressure in the fire lines sufficient to keep the large fire pump from starting unless pressure drops below its set point of 60 psig. An automatic priming system for the centrifugal pumps assures immediate delivery of water whenever centrifugal pumps are started or alternated.

A 16-in. river water pressure pipe for general service and a 12-in. pipe for fire service are laid underground to connect with the distribution lines. The Underwriters steam fire pump in the powerhouse was retained to supplement the automatic turbine fire pump. All river water for general service is passed through a revolving basket, self cleaning strainer located in the boiler room basement. This unit is equipped with 20 x 20 mesh cones to remove foreign matter passing through the intake screen. All river water is chlorinated in the pump house by an intermittent cycle chlorinator to prevent algae or bacterial growths.

Master Panel Board

In order to provide close surveillance of the various functions of the power plant, it was considered advisable to install a master panel board in the engine room for indication and control. This panel board contains all the necessary gages to keep the operator informed about all the equipment under his jurisdiction, including pumps located in the outlying buildings.

Instrumentation includes indicating thermometers showing the temperature of the river water, well water, steam, condensate, and softened water. Indicating pressure gages show the pressures of the service water, four main steam services, fire system, service air, instrument air, condensate, raw water booster pump and boiler feedwater. The three pressure reducing valve controllers also are mounted on this panel board as well as altitude gage for the well water tank.

Provisions are made for 47 indicating lights to show on, off, overload, high and low water level, and high and low pressure. Push button contacts control both on and off operation, and the audible alarms can be silenced although indicating lights stay on until the difficulty is corrected. In addition to the general utility of this panel board, it possesses a pleasing appearance and has been the subject of much favorable comment from visitors at the plant.

The Architects and Engineers, J. and G. Daverman Company of Grand Rapids performed an excellent service in working out the many details connected with this project.

PRINCIPAL POWER PLANT EQUIPMENT

Steam generators	The Wickes Boiler Co.
Burners and pumping equipment	Peabody Engineering Corp.
Induced draft fan	American Blower Corp.
Furnace draft regulator	Ace Instrument Co.
Soot blowers	Diamond Power Specialty Corp.
Blowdown valves	Yarnall-Waring Co.
Feedwater regulator	Copes-Vulcan Division
Combustion meters	Bailey Meter Co.
Water column	Wright-Austin Co.
Boiler feed pump (centrifugal)	Union Steam Pump Co.
Boiler feed pump (duplex)	Dean Bros. Pumps, Inc.
Makeup booster pumps	The Deming Co.
Condensate booster pumps	The Deming Co.
Chemical pumps	W. H. & L. D. Betz
Hot process softener	The Permutit Co.
Air compressor (general service)	Chicago Pneumatic Tool Co.
Air compressor (instrument air)	Nash Engineering Co.
Pressure reducing valves	The Swartwout Co.
Hot water heater	Aerco Corporation
Expansion joints	Yarnall-Waring Co.
River water service pump	De Laval Steam Turbine Co.
River water service pump	Union Steam Pump Co.
Fire system pump (centrifugal)	Peerless Pump Division
Fire system pump (duplex)	Blake & Knowles
Fire system leakage pumps	Aurora Pump Co.
Vacuum priming system	Nash Engineering Co.
Traveling water screen	Link-Belt Co.
Rotary water filter	S. P. Kinney Engineers, Inc.
Chlorinator	Fischer & Porter Co.
Master control panel	Kirkhof Electric Co.
Water consultant	W. H. & L. D. Betz
Architects and Engineers	J. & G. Daverman Co.
General contractor	Elzinga & Volkers
Electrical contractor	Kirkhof Electric Co.
Piping contractor	Industrial Piping Co.
Design	Parke, Davis & Co.

Service water pump station and substation No. 4 (above) are served from primary switchhouse (right); municipal power plant can be seen in the background.

. . . electrical system

Anticipating the inadequacy of the original electrical facilities, Parke-Davis installed a new electrical layout making use of latest industrial power distribution practices.

H. H. HUNT
Assistant Superintendent of Engineering

IMMEDIATELY upon acquisition of the Armour Leather Company property at Holland, Michigan, the electrical engineering department was asked to examine the premises and to evaluate the existing electrical system in terms of its suitability for the proposed manufacturing operations. It was to also determine the alterations and additions necessary for the new manufacturing processes.

The Armour Leather Company derived all of its electrical power from two steam engine generator sets and one turbine generator set. These units were rated as follows:

Ridgeway Engine Generator Set ..... 500 kw
Skinner Engine Generator Set ..... 160 kw
Allis-Chalmers Turbine Generator Set ..... 300 kw

All three steam prime movers utilized steam at boiler house pressure of 140 psig. The engine generator sets exhausted to the plant's 5-psig steam system. The turbine generator set exhausted to atmosphere.

The system operated at 220 volts, 3-phase, 60-cps. The system was isolated, having no interconnection with any other power source. It is presumed that the electrical requirements of the Armour Leather Company very closely followed their 5-psig steam requirements, with additional electrical demands being made up by the turbine generator set operating through the atmospheric exhaust.

The switchboard was of the open knife switch and fuse variety; all generator controls were manual. Switchboard control of engine or turbine speed was not provided. Consequently, the three generating units could not be paralleled. The plant load was divided in such a manner that each unit carried a separate section of the plant.

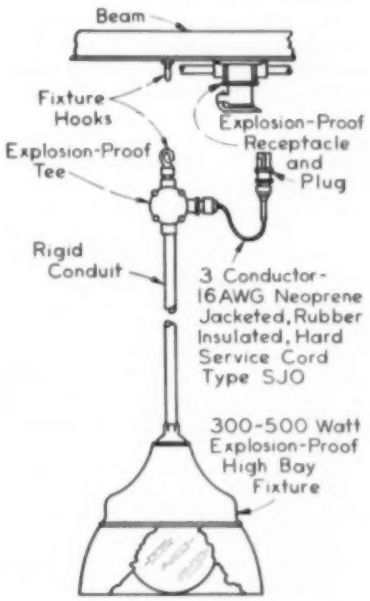
Distribution of power to the manufacturing sections was made through open wiring in overhead spans between buildings and also in open wiring throughout the buildings proper. Knob and tube work was used almost exclusively for all branch circuit wiring within the buildings.

A thorough study was made of the condition of the steam generation equipment. Considerable cylinder wear was evidenced, and extensive repairs would have been necessary to place this equipment in the proper operating condition.

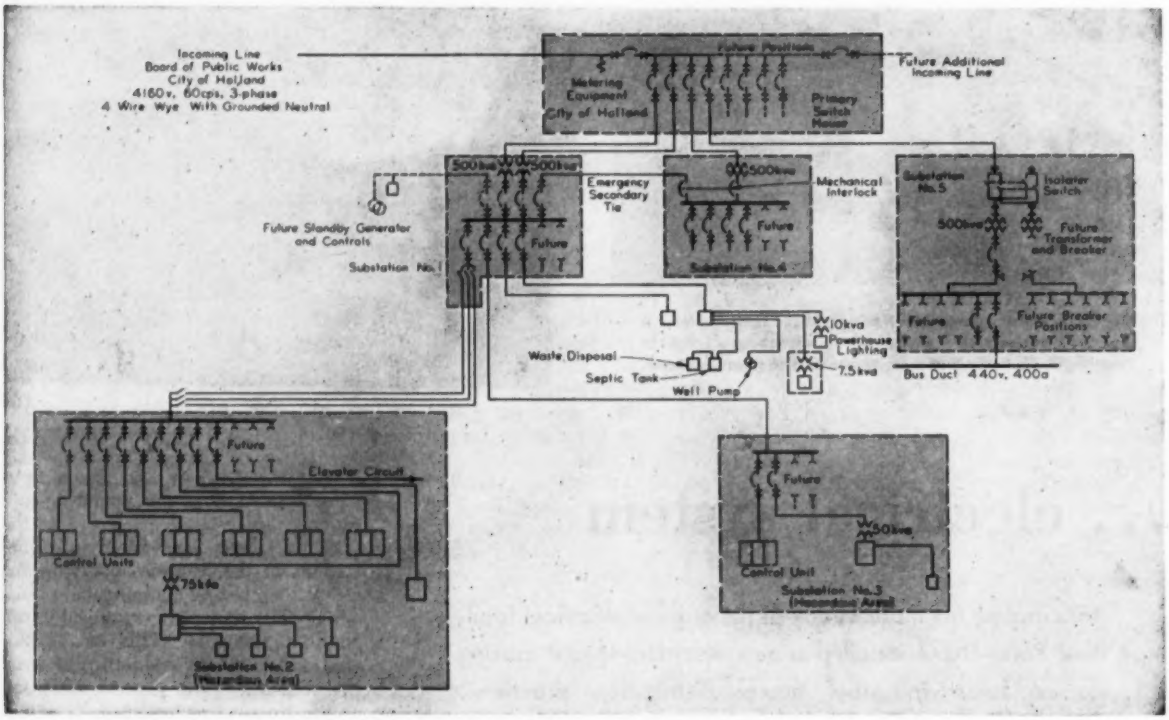
Many factors were taken into final account in the decision involving the use of the existing equipment:

(a) The system was arranged to operate on 220 volts. This was considered too low for modern industrial practice. Also, the general condition of the distribution and branch circuit wiring was extremely poor.

(b) The system was completely isolated from other sources so that all


Beam
Fixture Hooks
Explosion-Proof Receptacle and Plug
Explosion-Proof Tee
Rigid Conduit
3 Conductor-16AWG Neoprene Jacketed, Rubber Insulated, Hard Service Cord Type SJO
300-500 Watt Explosion-Proof High Bay Fixture

Demountable high-bay lighting fixture for use in hazardous areas.



Over-all electrical distribution schematic diagram showing interconnections between and within major load centers.

generation reliability was put upon the outmoded generating sets.

(c) Investigation of costs revealed that the addition of switchboard speed control for the generating units would be extremely expensive. Furthermore, a study of the electrical characteristic curves of the three machines indicated that even with proper speed control, the characteristics of these machines would not be correct for parallel operation.

(d) All three generating units were in poor mechanical condition.

(e) The proposed manufacturing operations contemplated very little use of 5-psig steam. For this reason, exhaust would have to be to atmosphere at least during the summer months, would not be correct for parallel operating costs.

(f) The original units were considered unsuitable even for standby power generation. The immediate effect of power failure would be stoppage of steam boiler auxiliaries. Service could not be restored since power would depend on steam supply. This would especially be true for the Allis-Chalmers turbine, which would deplete the entire steam supply of the boilers before attaining operating speed.

In view of these factors, no reason was seen for utilizing any of the existing electrical work in the plant. Consequently, it was decided that the entire system should be replaced.

New System

The decision was made to employ a basic radial distribution system, using the service offered by the Board of Public Works, City of Holland, as a source. Power is brought into the plant at 4160 volts, 3-phase, over 4 wires; it comes through an overhead line to the company property, and thence in underground lead cable to the primary switch house. From here, a primary service is run to three transformer substations located in strategic areas.

The transformer substations reduce the voltage to 480 volts, 3-phase, for general service. Distribution transformers, located where required, are used for lighting and miscellaneous single phase requirements.

Distribution panel boards for the 480-volt service are located in the power plant and in the hazardous area locations (substations No. 1, 2, 3, and 4). Bus duct is used for distribution in substation No. 5 because loads are rather widely separated geographically, and because this area is non-hazardous.

The following major elements were taken into account in the design of the new electrical system: installation cost, operating and maintenance cost, system reliability, hazardous occupancy, and provisions for future expansion.

By distributing power at 4160 volts, a considerable saving in cable cost is realized. Transformer substations are located as near as possible to the load centers, making secondary runs as short as possible and reducing line losses to a minimum. Transformers are not permitted in hazardous areas. This gives rise to rather long secondary lighting branch circuits. The situation is considerably aggravated by the high-bay type of installation required.

Voltage drop calculations, based on 110 volts, indicated that branch circuit wiring would have to be approximately No. 2 AWG for a standard 20-ampere circuit. This difficulty is avoided by employing 120/208-volt, 3-phase, 4-wire circuits with 3-pole

breakers at the lighting panels with a common neutral return for 3 poles. Contactor control is used for operating the lights. In this way, standard 120-volt lamps can be used, gaining the advantage of 3-phase lighting distribution at 208 volts. This arrangement allows a considerable reduction in wire size and at the same time, permits an acceptable voltage drop.

Operating and Maintenance Cost

Serious consideration was given to the possibility of supplementing the electric supply and reducing operating costs through by-product steam generation. This type of system has considerable merit under the proper circumstances. For this application, however, it was rejected. The majority of the requirements are for steam at 40 psig or higher. In order to operate successfully under these conditions, it would be necessary to generate steam at a substantially higher pressure and then run it through a topping or extraction turbine for by-product power. The relatively small size of the steam plant required for process steam precluded the economic possibility of generation at these higher pressures. Consequently, consideration of by-product steam generation was rejected. All electric power is, therefore, purchased from the City of Holland.

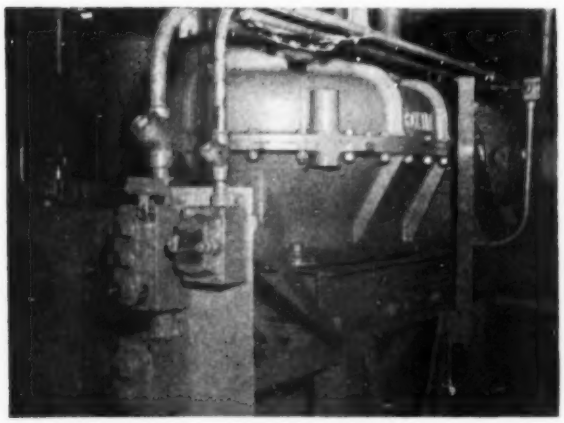
The system is designed for minimum maintenance cost through the universal application of circuit breakers on all circuits, including main primary breakers and 480-volt distribution breakers. Power can always be restored rapidly and cheaply with minimum down time and none of the common troubles associated with power circuit fuses (fatigue, single-phasing, "slugging a circuit over its rating.")

Control unit stand in substation No. 2 showing method of installing motor starters and power distribution panel.

The main primary breakers and the main 480-volt secondary breakers are all draw-outs. They are easily interchangeable, rating for rating. This makes for ease in cleaning and maintenance, and promotes system reliability throughout.

All branch circuits are numbered using a uniform coding system. Each push button and each motor is equipped with an engraved tag identifying the panel and circuit number associated. A considerable amount of time is saved in tracing and locating trouble.

The maintenance of explosion-proof lighting fixtures, especially the high-bay type, is often a problem. In order to clean or re-lamp with a conventional system, it is necessary to remove the globe and guard while working from



Control station for agitator drive in hazardous area (left); the motor starter is standard model installed in non-hazardous area (right). Cost of connecting wiring is more than made up by minimized use of explosion-proof components.

the top of a long ladder or similar device. In order to avoid this, high-bay units of the type illustrated were installed. Each lighting fixture is equipped with an explosion-proof plug and receptacle and a fixture hook. In cleaning and re-lamping, it is only necessary to unplug, unhook, and lower the unit to the floor with a rope. All maintenance work is done at floor level. In addition to this advantage, it is inexpensive and simple to relocate these fixtures. Fixtures can be relocated over an area of several feet by merely moving the fixture hook and extending the flexible cord.

System Reliability

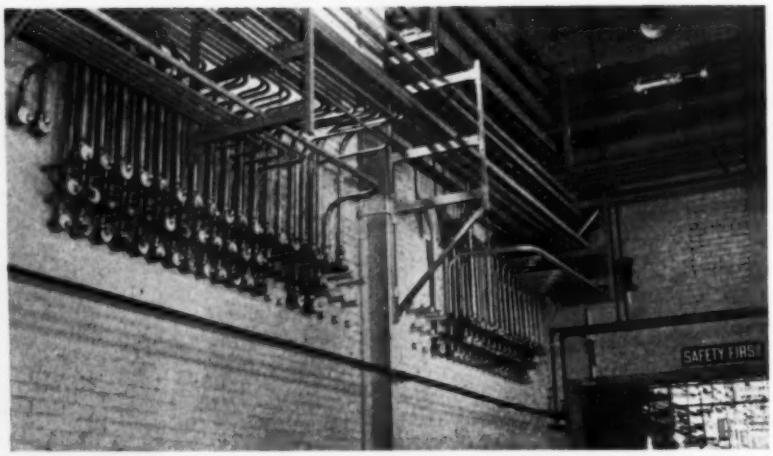
A basic radial distribution system was adopted because of its lower installation cost and because the geographic locations of the various substations made a loop system impractical. One difficulty with a radial system, of course, is that no alternative power source is available in case of equipment outage. In selected areas, where system reliability is especially important, several modifications were made to the basic radial system in order to achieve added reliability.

Provision is built into the primary switchhouse for an additional incoming line section which, if events prove it necessary, will allow main service to be changed to a primary selective type of arrangement.

Service to substation No. 1 is provided through two sets of primary cables, two transformers, and two secondary circuit breakers. Each of these transformers and its associated cable is designed to carry adequate power for all essential services. If either one of the lines is out of service, operations may carry on over the other in the power plant and in the main manufacturing areas served by substations No. 2 and 3.

Multiple cables are used in the feed to substation No. 2. Provision is incorporated for disconnects which would permit removal of any one of the cables from service in case of failure; a rather substantial proportion of operations would still be sustained during the repair. It was not felt necessary to provide this alternate service for substation No. 3.

Substation No. 4 provides power for pumping service water and fire protection water. In order to provide emergency service to this area, it was feasible to run a small secondary tie, sufficient for any emergency purposes.



Explosion-proof conduit fittings carry interconnecting wiring between hazardous and non-hazardous areas as in central switchroom wall in substation No. 2, above.

Provisions are incorporated in the switchgear for substation No. 1 for the addition of the future, standby, diesel engine generator and controls. This would provide 480 volts, 3-phase, to substation No. 1 bus thereby supplying the power plant, the emergency water pumping requirements at substation No. 4, and the emergency requirements for substations No. 2 and 3. The emergency requirements for the entire plant would then be served without reference to any high-voltage equipment. This would be particularly important if the outage existed in the primary switchhouse.

Substation No. 5 is equipped with an isolator switch which would provide primary selective service in the event that this might prove necessary in the future. Since this area is not completely developed, it was unnecessary to install additional cable or transformer capacity at this time for emergency purposes.

Hazardous Occupancy

The main manufacturing areas, which are served by substations No. 2 and 3, employ liquids of an inflammable and explosive nature. For this reason all wiring in this area is the explosion-proof type for Class 1, Group D, occupancy. A study was made of the relative cost involved in installing explosion-proof power and lighting distribution panels and installing explosion-proof motor starters compared with the cost of placing these items in a central location and utilizing non-explosion proof type of equipment there. A definite cost advantage was found in establishing a central enclosed area for housing non-explosion-proof units of this nature.

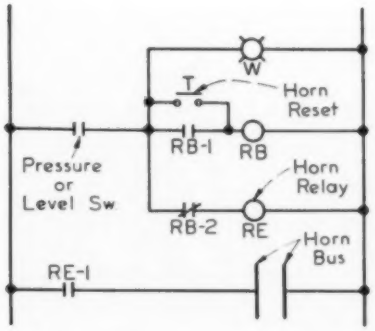
Controls and Conduits

All motor controls are the magnetic type, and are located within the central switch room. Pushbuttons and motors are the explosion-proof type and are located in the operating areas. Power to the various operating units is carried through a conduit system sealed at the outer wall of the enclosed area, using approved fittings throughout the hazardous areas. Spare conduit connections are provided for future additions to the system.

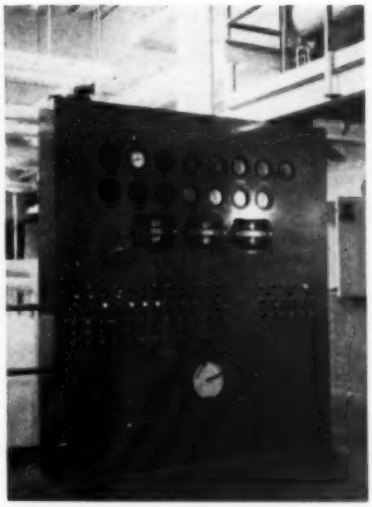
A series of control unit stands are established in substation No. 2, each consisting of a power distribution panel mounted on a steel back plate, with square duct extending outward from the sides of the panel. The motor starters are installed on the steel back plate and are wired through the square duct. Each motor starter has its own associated branch circuit breaker in the power distribution panel.

Compactness

This type of installation has the advantage of extreme compactness associated with neatness, accessibility, and flexibility. Each control unit can accommodate up to 30 Size 1 motor starters, with provisions for installing Size 2, reversing, or other special-type starters as may be required later. By installing these units in a back-to-back



Alarm circuit (above) permitting optional cutoff of tone signal.



Master control board (right) in the power plant's engine room.

arrangement, it is possible to provide a total of 60 Size 1 starters, and 12 or 16 Size 2 or reversing starters. All this goes in a space approximately 12 feet long, 8 feet high and 3 feet deep.

This installation is near the ultimate in compactness. The type of starter employed for this installation is particularly well suited by reason of the physical characteristics of the starter enclosure.

Lighting

Lighting in the office sections and in the non-hazardous production spaces makes use of fluorescent fixtures. The power plant areas, utility spaces, and all hazardous areas are lighted with incandescent lamps. Explosion-proof fixtures are used in the hazardous areas. Approximately 40 foot-candles have been provided for office and non-hazardous production areas. Hazardous production area is lighted to approximately 20 foot-candles.

Special Circuits

A number of special circuits for control and for alarm service have been employed throughout the plant. A rather unusual alarm circuit was proposed for use in connection with the master panel control board. The basic circuit is illustrated. Variations of this circuit are employed for different elements on the control board.

Operation of alarm circuit follows: closing the pressure or level switch contacts energizes horn relay, RE. This energizes the horn bus. (A separate horn relay, RE, is provided for each of the circuits requiring alarm service.) The white pilot light, W, is energized at the same time. When the operator wishes to turn off the horn to avoid annoyance, he presses the horn reset key and de-energizes RE, turning off the horn. The white light continues to burn as long as the pressure or level switch contacts are closed. As soon as the trouble is cleared, and pressure or level switch contacts open, the white light goes out, and RB also drops out, returning the system to normal.

This system has the advantage of allowing the horn to be cut out of the circuit. However, it is impossible for the operator to forget and leave the alarm system in the locked-out position. The system automatically becomes ready to receive and sound the next alarm once the trouble is cleared. This system is proving very satisfactory. In addition to the white light, red and green operating lights are provided on the master panel control board to indicate the operating condition of each unit.

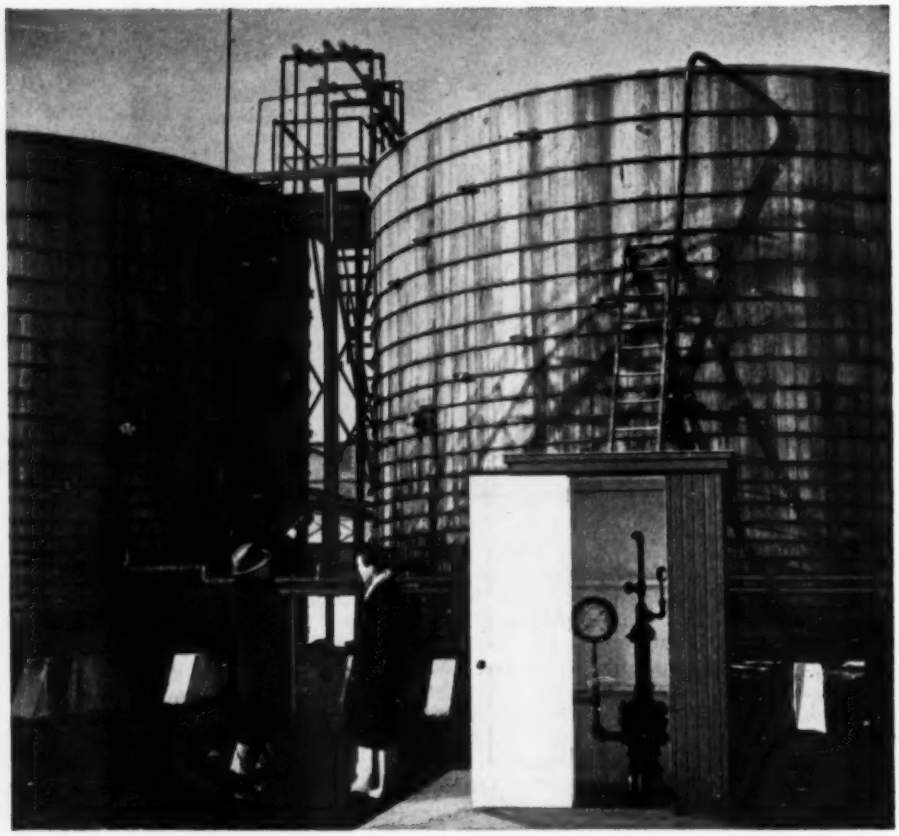
Future Expansion

Each element of the electrical system has been arranged to permit expansion commensurate with the degree of area occupancy. Where areas are nearly filled with equipment, provisions for expansion are rather moderate. Where areas are capable of considerable additional development, such as substation No. 5 and the primary switchhouse, a proportionately greater expansion provision has been included. These provisions take the form of additional cubicle space for main secondary breakers, and additional space in the primary switchhouse in the case of primary expansion. All lighting and power circuit breaker panel boards are provided with spare circuits so that additional equipment can be installed in any portion of the plant with no additional panel board equipment.

These have been main design considerations in establishing the new and highly specialized electrical system to fit the requirements of a new process being installed in an existing set of buildings. Many compromises were necessary between cost and complexity. With due regard for the many factors that always exist in this type of a situation, it is believed that the best balance has been achieved between all factors which had to be considered.

PRINCIPAL EQUIPMENT

Design, drawings, and specifications for main system	Parke, Davis & Co.
Design, drawings, and specifications for power plant, substation No. 5, and associated buildings	J. & G. Daverman Co.
Special control circuits	J. & G. Daverman Co.
Electrical installation and fabrication of switchboards	Kirkhof Electric Co. (I-T-E circuit breaker equipment)
Primary circuit breakers	Westinghouse Electric Corp.
Main distribution transformers	Uptegraff Transformer Co.
Power and lighting circuit breaker panel boards	Westinghouse Electric Corp.
Bus duct	Westinghouse Electric Corp.
Motor starters	Square D Co.
Push button and pilot light elements	Square D Co.
Distribution transformers	Westinghouse Electric Corp.
Fluorescent lighting fixtures	Sylvania Electric Prod., Inc.
Fluorescent lighting fixtures	Daybrite Lighting, Inc.
Explosion-proof conduit fittings and explosion-proof push button stations	Crouse-Hinds Co.
Explosion-proof lighting fixtures	Crouse-Hinds Co.
Motors	Supplied by equipment manufacturers



After passing through a reclamation plant, the wastes from the process are discharged into two large storage tanks and then pumped into a well, which is 1600-ft deep, to eliminate any possible surface water pollution.

. . . waste disposal

Waste disposal is one of industries' public responsibilities. Parke-Davis uses four separate disposal systems for different types of waste so that none contaminates streams or lakes.

J. ADINOFF
Senior Chemical Engineer

AS THE DISPOSAL OF PROCESS wastes has become a serious consideration in the plans and designs for new chemical plants, Parke, Davis and Company recognized the problems involved and its public responsibilities when building its new plant at Holland, Michigan. Located at the mouth of Black River and the head of Lake Macatawa, any water-borne wastes emptied into the streams would immediately enter into a lake used for swimming, boating and fishing. This lake is also a watercourse upon which the homes and industry of Holland and surrounding communities are located. Furthermore, since the new plant (and many other companies on the lake) would use this water for its service water requirements, the demand for a high quality effluent was recognized at the outset.

An outline on the program of attack for the disposal of wastes, whether from manufacturing plants or from an entire city involves three steps:

A. Identification of wastes as to nature and quantity.

B. Waste collection and handling.

C. Waste treatment and disposal.

The course of action Parke, Davis and Company used in handling the fluid wastes from the Holland, Michigan Plant followed this outline.

Identification

The manufacture of chloromycetin by organic synthesis is carried out in a batch-process procedure divided into eight major steps involving forty separate and independent manufacturing operations. The engineers responsible for the waste disposal problem carefully scrutinized each operation, the reaction, the chemicals used, the yields

and the unreacted compounds involved, wastes from washing operations during filtering steps, solvent recovery, by-products, and all related information. A list was made of all wastes that would have to be disposed of, and a program for the collection of data as to quantities and chemical nature was instituted. Assays on each waste tested covered the following: pH, B.O.D. (biochemical oxygen demand), suspended and dissolved solids, solvents, toxicity, color, and chlorine demand.

Upon the completion of the initial pilot plant work on synthetic chloromycetin and observation of the production work then underway in Detroit, it was recognized that several of the wastes contained considerable quantities of spent solvents. After the decision was made to erect the permanent and large scale plant at Holland, a program was originated to study the best means of solvent recovery. The wastes that were to be disposed of, after the stripping of the solvents, had to be made up synthetically for an assay. This was done by collecting the process wastes resulting from the production work in Detroit and treating them in the pilot plant in a manner similar to the solvent recovery methods then being investigated. While this pretreatment had as its primary purpose the recovery of the solvents, it had a direct effect on the waste disposal problem, as it lowered the B.O.D. of the spent liquors, reduced their toxicity, and as a result of the heat of distillation, caused modifications in the character of the wastes by the formation of solids and tarry compounds.

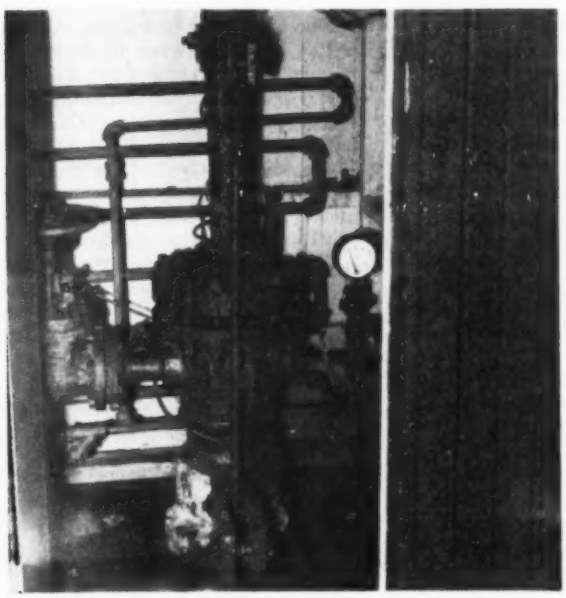
The analysis program resulted in four process wastes being identified as deleterious. These required investigation as to the methods to be used for their ultimate disposal. All other waste liquors were found to be of satisfactory quality. A tabulation of the four deleterious waste liquors, blended together in the proportions expected from normal production operation, is presented in Table 1 and shows the problem and magnitude of the final disposal problem.

Collection and Handling

The most important feature in the simplification of ultimate disposal of deleterious wastes is the concentration of these wastes in as small a volume as possible, not further complicated by large volumes of water coming from other sources in the plant that can be treated or disposed of through more normal methods. It should be noted also that the design and construction of the Holland plant had to start immediately upon purchase of the property, and as the sewers must go in first, a truly flexible and yet practical method of collecting the wastes had to be installed. Therefore, before practically any data were obtained as to the exact nature of the process waste or its ultimate treatment, it was decided to install a four-sewer system in the plant.

1. Sanitary System—Standard sewer construction for sanitary wastes was used for the system, with cast iron pipes being used for all lines within and under the buildings. Vitrified clay sewer piping was installed for all outside lines, which terminated at a manhole just prior to entry into a septic tank for final waste purification.

2. Service Water Wastes System—As the spent cooling water coming from reactor and kettle jackets and condensers on processing equipment and refrigeration compressors was foreseen to be uncontaminated and completely innocuous, provision for its complete separation from any process wastes was included in the design. Double Y's were placed vertically approximately 24 in. above floor level at convenient intervals throughout the manufacturing buildings to allow for the collection of all service water wastes. These drain fittings were then connected to underground cast iron



Disposal well is constructed with a 7-in. steel casing surrounding the 2-in. heavy wall waste injection line.

TABLE 1 — ASSAY OF COMPOSITE SAMPLE OF PROCESS WASTES

Wastes are complex, unidentified organic compounds formed by the decomposition of organic materials used in the process. Ions present include sodium, chloride, ammonium, acetate, bromide, and nitrates.

Assay of sample

pH	3.7
B.O.D. (20 day)	45,000 ppm
Dissolved solids	60,000 ppm
Color	reddish-brown (12,000)*
Toxicity	2 to 5 per cent**

Composition of sample

Bottoms from solvent recovery plant	52.9 per cent
Wash "A" from a filtering operation	30.1 per cent
Wash "P" from a filtering operation	7.5 per cent
Liquor "S", filtrate and washes	9.5 per cent
	100.0 per cent

* Color standard in "Standard Methods for the Examination of Water and Sewage"

** Threshold concentration for toxicity of Great Lakes shiners

Process wastes pass through a solvent recovery plant. Photograph shows reclamation system control panel.

Sanitary system wastes are collected in septic tanks and chlorinated. Then effluent is pumped to the river.

sewers which led into clay pipelines outside of the building confines, then eventually into the main plant outfall at Lake Macatawa. The foresight in designing for this separation of the large volumes of spent cooling water was a distinct aid in reducing the quantities of contaminated wastes and materially assisted in the eventual choice of a method of disposal for the process wastes.

3. *Equipment and Floor Washings* —A third sewer system was installed to collect all equipment and floor washings and accidental spills in the manufacturing areas. Upon reviewing the materials of construction commercially available for handling practically any form of highly acid or alkaline chemical waste—possibly with solvents present—it was decided to use double-strength vitrified clay sewer pipe for this installation. The problem of sealing the bell and spigot joints was solved by using a special alkali and acid resistant mortar made by the Nukem Company, identified as their "All-Purpose Resinous Cement." This material appeared to have a very wide range of resistance to chemical attack to adequately resist corrosion by the chemicals which would be encountered at this Holland plant. These sewer lines, carefully installed in order to minimize the possibility of any fractures of the rather "stiff" joints made with this special mortar, were routed to a special 6 ft diameter manhole installed at the waste disposal plant. In following through on the method of corrosion resistance, the manhole was constructed of acid and alkali resistant brick and mortar.

4. *Deleterious Process Wastes* — It was decided in the initial stages of construction that all lines handling wastes of deleterious nature would be installed above grade. In this way a pin-point pickup and yet a flexible and economical method for carrying these wastes could be expected. In addition, the wastes would not be increased in fluid volume by the waters from the cooling water or floor drain systems. A third advantage was in the economy that could be made in the installation and maintenance of the 1½ in. and 2 in. pipelines if the wastes were pumped to the waste disposal plant.

Treatment of Wastes

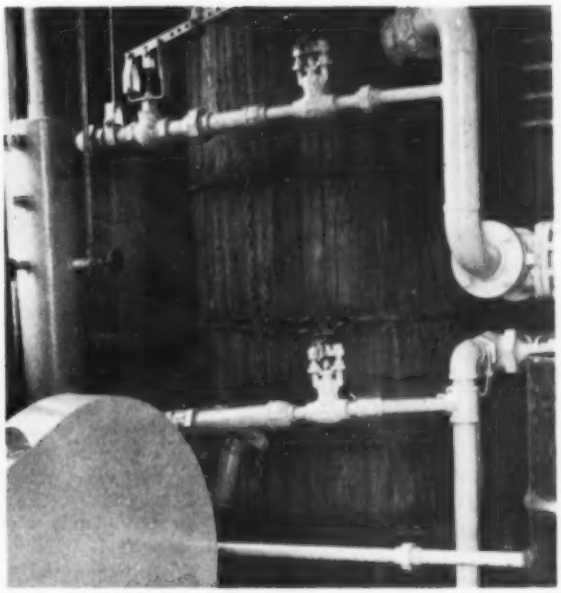
Black River is a comparatively narrow river with a small amount of drainage area and with a very low rate of flow in the summer and other dry periods. Consequently there is no dilution factor of any consequence from Black River and the watercourse at the plant site is practically a backwater or bay area. For this reason, and with the desire to maintain Lake Macatawa in as high a quality as possible, Parke, Davis and Company set its sights on producing a waste effluent containing a negligible quantity of contaminants.

One of the first investigations made on the composite waste liquor sample was the neutralization of the acidity to a level permissible for dumping in the Black River. The wastes contain a very high percentage of dissolved salts which act as excellent buffering agents and indicate any neutralization of the process wastes which, on plant scale operations, would be quite expensive.

Figure 1 outlines the results of an experiment in which the composite waste was titrated with sodium hydroxide at various concentrations. Further tests with hydrated lime as the neutralizing agent also indicated that its consumption by weight was identical with that of the caustic soda.

While neutralization would make the pH acceptable, it would not eliminate any of the other objectionable features of the process wastes. A test was also run to reduce the color of the wastes. A treatment with activated carbon reduced the color approximately 80 per cent to a level of 2000 ppm by the platinum-cobalt method, which is still a

This pilot plant installation was used to investigate the feasibility of a biological type waste treatment.



A porcelain lined triplex pump receives treated waste from a sand filter and pumps it to the disposal well.

definitely colored waste. Such treatment, added onto a disposal system as a final treatment step, involved a high operating cost for materials and labor and was not deemed satisfactory — again in view of the still unsolved problems of toxicity and B.O.D.

Evaporation of Liquors

Another method of disposal investigated was that of evaporating the aqueous liquors. Investigation of this approach proved that this method did not completely solve the problem. If dumped on the ground the residue, being largely soluble, would leach into and pollute the ground waters of the area and eventually the river and lake itself. No space was available in the Holland area for dumping the residue on any isolated beaches located on Lake Michigan. Further disadvantages of such a system were the high operating costs and the initial investment for construction of the evaporator to handle such a corrosive liquor (unless a separate and expensive neutralization, pretreatment step was also used). However, to protect the continuity of plant operations and always guarantee a high quality effluent into the Black River even if the treatment process finally decided upon had a temporary breakdown or prolonged repairs, Parke-Davis deemed it advisable to have a stand-by evaporator available. This was accomplished by altering the design of an evaporator installed in the solvent recovery plant to also handle the waste liquors (after neutralization) if the situation ever arose.

Simultaneous with the other investigations underway, it was deemed advisable to investigate the reduction of the high B.O.D., color, and toxicity levels by biological means. A small pilot plant installation was made using an 18 in. diameter, 3 ft long, clay sewer pipe as the trickling filter with a small adjustable stroke piston pump for the feed and a small gear pump for recirculation. Laboratory flow meters and other accessories made in the company shops provided the balance of the equipment requirements. Initial operation was maintained by obtaining seeded rocks from a trickling filter at the municipal sewage treatment plant at Pontiac, Michigan, and by using a synthetic feed media cycled through the filter. After several days a small amount of waste liquor (adjusted to pH 7.0) was added to the synthetic media, and as a strain of organisms developed which would live on the process wastes, the synthetic media was gradually discontinued. At this point, various concentrations of the feed at several and continually lower pH were experimented with, using a high recycle ratio of 30:1.

In the meantime test work on another means of waste disposal bore fruit, and further work on the trickling filter pilot plant approach was dropped. However, the data accumulated at that time indicated an approximate reduction of 50 per cent of the B.O.D. with unsatisfactory reductions in the toxicity, color and salinity. While it is believed that continued work on the pilot plant would have given essentially satisfactory results, the process did not compare favorably to the first method of disposal because: (a) high initial investment; (b) filter might not be able to handle wastes from new products; (c) in the event of a plant shutdown the filter organisms would perish.

Underground Well

While investigations were underway on the above methods of waste treatment, the practicality of disposal of the process wastes by an underground well was also being reviewed. Since oil is pumped in the Holland area, a survey was made on the locations and geological data recorded from about thirty, dry-hole well borings in the neighborhood. Consultation with the State of Michigan Conservation Department gave a definite pic-

ture of the sub-strata formations under the plant site, which indicated a porous, brine-saturated limestone strata approximately 1600 ft below grade and probably 200 to 300 ft in thickness. Samples of the brine and limestone obtained from other drillings were tested with the process wastes and the indications were that there would be no objectionable chemical reactions. Since the plans were to use no pretreatment, other than settling, corrosion of the well casing was a serious problem and the well was constructed as follows: a 7 in. carbon steel casing was extended into the limestone formation which was then drilled out another 200 ft (this being left as open hole), and a 2 in. heavy wall tubing line was installed within the casing to actually carry the waste liquors. In the event that the inner pipe corrodes it can be quite easily replaced.

The balance of the process waste disposal system was handled by installing two, 40,000 gal, wooden holding tanks to hold the waste liquors and allow for balancing out of flow levels and settling out of suspended solids and tarry residues formed by prolonged standing. A wooden sand gravity filter and a porcelain-lined duplex piston pump completed the installation of corrosion-resistant equipment required to filter and discharge the wastes.

The floor drainage from the manufacturing areas empties into a 6 ft diam manhole at the waste treatment plant location. Two, vertical, sump-style centrifugal pumps, operated by a float-control were installed to pump all wastes from this system into two, 20,000 gal, wooden holding tanks. As tanks operate alternately on a batch fill and draw basis, the disposal plant operator has sufficient time to check a filled tank for quality before permitting it to be dumped into the main sewer outfall. If there is any question as to the quality and nature of the waste liquors held in the 20,000 gal tank, it is pumped into the 40,000 gal wooden tanks used for the accumulation of the process wastes for ultimate discharge into the disposal well. The advantages of this type of a system for floor drain washings are threefold: (1) excellent safeguard over the quality of the dumped wastes, (2) ease of handling and low cost of installation and operation, (3) double-check on nature of liquors being dumped by the manufacturing departments. A C.O.D. (chemical oxygen demand) test has been correlated with the biological B.O.D. test to enable the analytical department to assay this waste in several hours and allows a check on each tank before dumping — a procedure that could not be followed if the 5 day B.O.D. control tests were used. A program is maintained to constantly check the accuracy of this chemical test versus 5 and 20 day B.O.D. tests if the wastes should change radically from the pre-established levels.

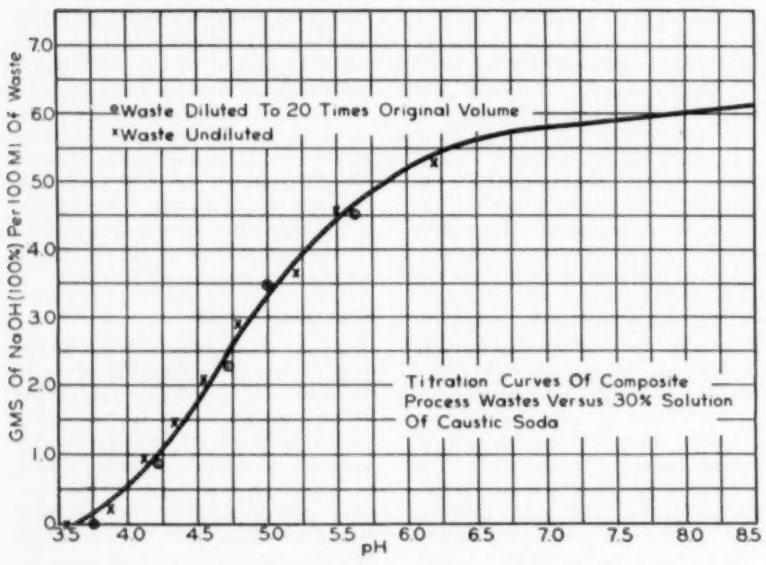


Fig. 1—Titration curve illustrates the results of neutralizing composite samples of process wastes with sodium hydroxide at various concentrations.

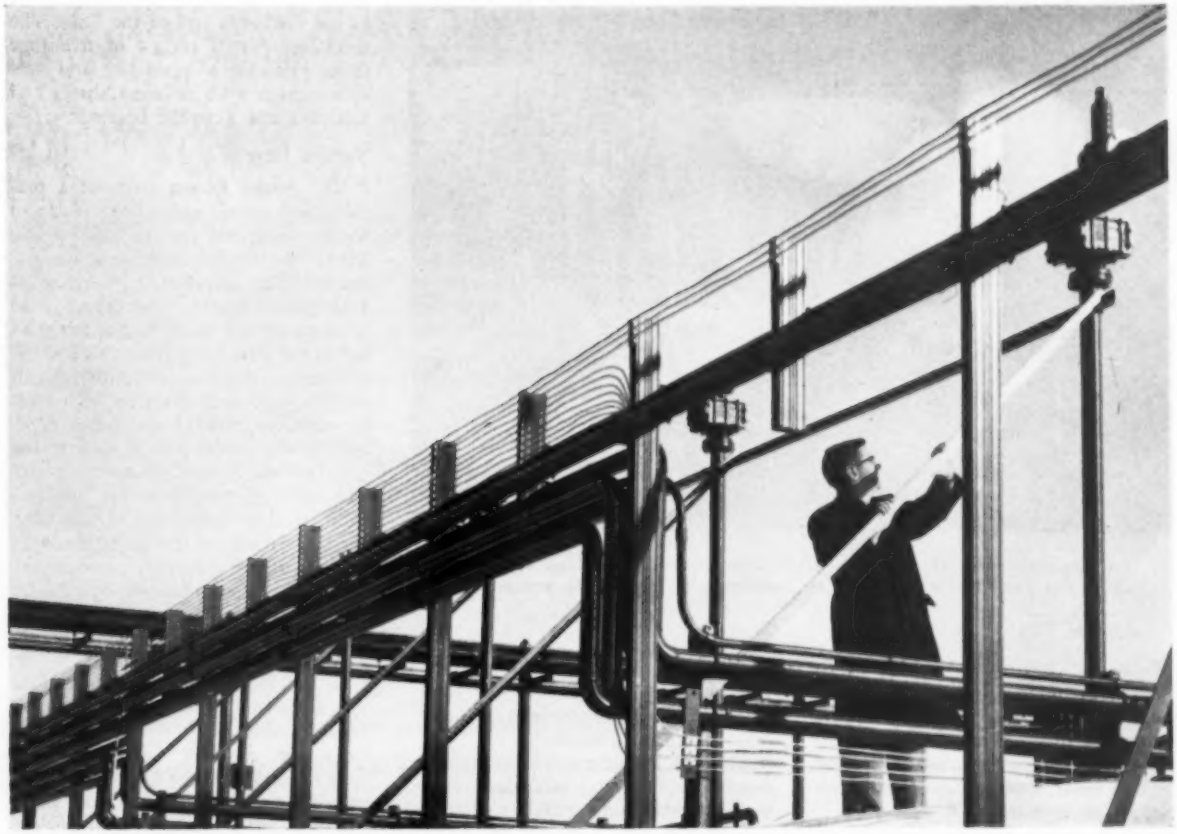
Sanitary System Waste

The wastes collected from the sanitary system are routed to a septic tank and chlorination chamber for treatment prior to discharge. A reinforced concrete structure, divided into three chambers was designed on the basis of the ultimate number of estimated employees per 24 hour day. The initial digestion chamber is a 20 ft 10 in. long by 5 ft 8 in. wide and 6 ft 6 in. deep structure with the bottom constructed as two hopper-shaped sections for semi-annually pumping out accumulated sludge and scum. The effluent then flows over a weir into a pumping chamber for elevation into the chlorination chamber, a design requirement resulting from a lack of available head and the high water level at the septic tank site. Standard construction, duplex, centrifugal sump pumps with float operated controls were installed to serve this chamber.

The pumping of the effluent to the third chamber is synchronized with the chlorination unit, a Proportioneers Chemofeed pump which injects a 10 per cent solution of sodium hypochlorite into the effluent at its point of entry into this final treatment chamber. The baffle arrangement of this third unit then allows for a minimum of 20 minutes of retention time of the wastes in contact with the hypochlorite solution. The Proportioneer pumping rate is set to deliver a sufficient quantity of chlorine solution to insure a residual amount of approximately 2 ppm of chlorine in the sanitary waste effluent. Daily checks of the chlorine content of the final effluent are made by means of a color slide comparator, using orthotolidine as the titration additive. Periodic samples are furnished the plant's analytical department for accurate chlorine content and B.O.D. assays.

Acknowledgments

While the coordination and design of this project was under the supervision of the author, the following cooperated on the many stages of the project: D. J. Vink and W. Roser, now of the Holland Plant; G. G. Cross, of the Process Development Department; J. E. Oyaas, of the Research Department; and R. G. McGathan and L. E. Oeming, of the Michigan Water Resources Commission.



Aluminum tubing — chosen for lightness, flexibility, and availability — joins the farm tanks with plant measuring gages.

. . . tank farm

Many factors dictated the use of an outdoor, partially-buried tank farm for the storage of fresh and recovered process liquids.

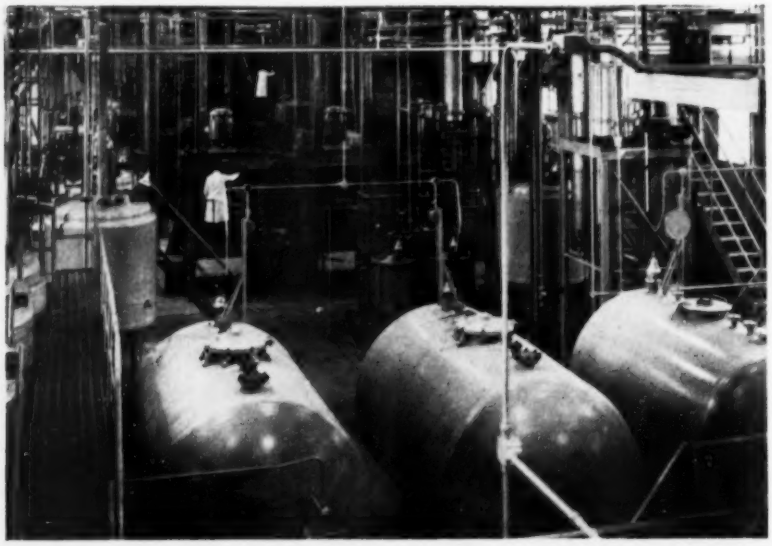
C. W. LINTNER
Manager, Chemical Engineering

IT WAS DECIDED, in the initial planning stage, to store the bulk of the solvents used at the Parke-Davis Holland Plant in an outdoor tank farm. Several factors prompted this decision: the tremendous economic advantage of buying in tank car lots; convenience and ease of handling; more favorable insurance conditions: comparative freedom from fire hazard; and economy in labor utilization.

To meet the Underwriters' Code requirements for an above-ground tank farm would have meant placing the tank at such a distance from the manufacturing buildings and the unloading station that the piping and pumping costs would have been excessive. Terrain features and high water table prevented installation of a completely underground system. The final decision was to bury the tanks as close to the main buildings as regulations would allow. The tanks were then set to a grade depth a few feet above the water table and mounded over with sand, earth, and crushed stone.

The tank farm comprises fifteen horizontal cylindrical tanks varying in capacity from two to fifteen thousand gallons. The tank size in each case was selected after a study of the amount of that particular solvent used per week, the amount capable of being recovered, and the tank car size available. Only seven solvents are handled, but a larger number of tanks are needed because some of the recovered solvents cannot be used in place of new solvents in all parts of the process and therefore must be stored separately.

One highly corrosive solvent required a stainless steel storage tank and allied pumping and measuring equipment. The rest of the tanks are made of carbon steel with a thermosetting, phenol-formaldehyde lining;

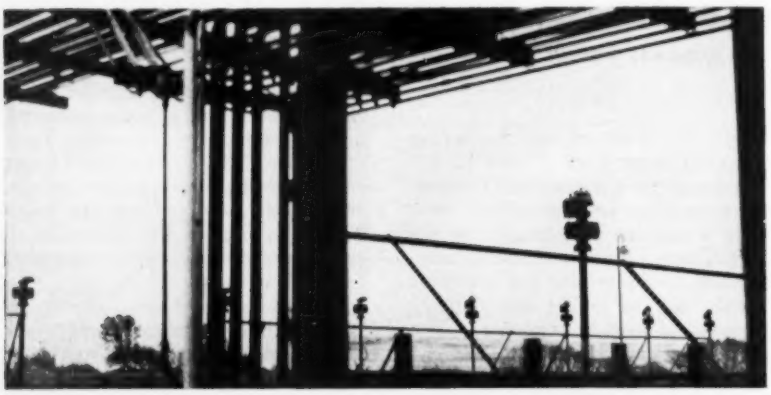


An intricate maze of piping, conduit, and tubing is required to route chemicals and to control the many operations in large-scale processing.

this lining is chiefly for rust prevention and for protection against any hydrolysis products caused by condensation. The tank exteriors are protected by two heavy applications of a bituminous asphalt coating.

All the tanks are securely anchored by steel U-bolts to a continuous concrete slab on the floor of the excavation. The large tanks rest on eight inches of sand directly on the concrete slab while the smaller tanks are supported by concrete saddles or steelwork so that the top outlets are all level. Flanged steel spools, two feet long, have been used to extend the top openings above the ground.

The tank farm furnishes solvents for three manufacturing buildings covering an area of some 20,000 sq ft with the longest runs approximately 600 ft. These solvents are pumped through fifteen steel or stainless steel welded overhead pipelines to metered outlets. The discharge pumps specified for the storage tanks are flange mounted, vertical, submerged, turbine type pumps powered by explosion-proof motors and controlled by the totalizing meters at the discharge end of the lines. The discharge pumps consist of five-stage units, primarily of plain iron and steel construction with stainless shafts and strainers and Textolite bearings.



Flanged steel spools extend the openings of underground tanks in the farm.

System Flow

The intake system starts at a prefabricated steel unloading platform located next to the railroad siding where the loaded tank cars are delivered. Cars are spotted by means of a motorized car puller. Proper hose connections are made to the lines on top of the unloading platform, and the solvent is pumped out through an eductor pipe and again through steel or stainless welded overhead pipelines to the proper storage tank in the underground farm. One stainless steel and two all-iron, positive displacement, modified gear type pumps have been installed in the pumphouse at the base of the unloading platform for handling all the unloading operations. All three pumps are rated 80 gpm and will unload an average tank car in less than two hours.

In addition to the supply of new solvents there are a number of pipelines running into the storage tanks from the recovery building which carry to storage all the solvents recovered by fractionating columns from waste liquors collected during manufacturing.

The totalizing meters on the discharge outlets can be set by the chemical operators to automatically deliver any desired quantity of solvent to the reactors. All the storage tank liquid level indicators are conveniently centralized on a large panel board in the intake pumphouse. A similar board with repeater indicators for those materials handled by the recovery system is located in the recovery building. For reasons of economy and simplicity, hydrostatic type instruments are used; in order to furnish instant readings they are operated by a compressed air supply instead of individual hand pumps. Compressed air is supplied by a separate instrument air compressor equipped with a silica gel drier to eliminate possible moisture condensation and freezing in the several miles of ¼-in. OD aluminum tubing connecting the outside storage tanks with the two instrument panels.

To date, very satisfactory and uninterrupted service has been given by this installation and most of the engineering decisions on design and equipment seemed well justified.

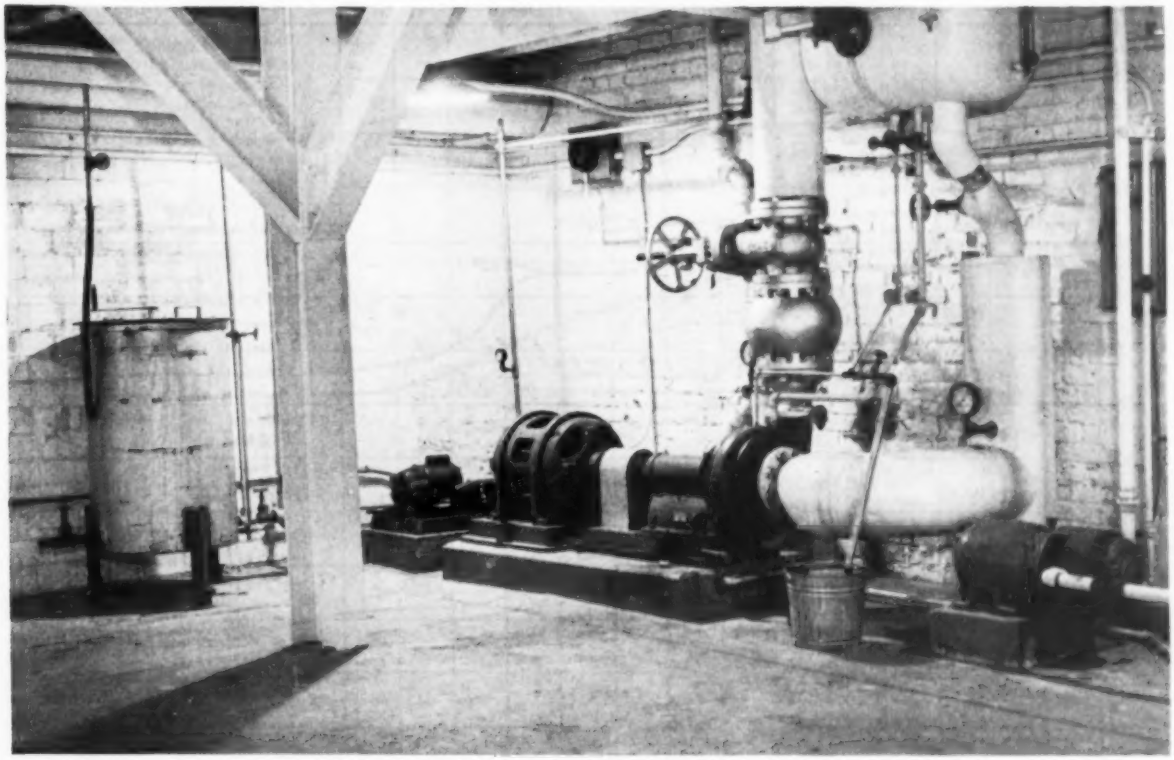


Photo shows chemical pump and tank, left; new centrifugal well water pump, center; vacuum pump with priming tank, right.

. . . well water supply

Finding the fill-and-draw pumping system of the old plant inadequate, Parke-Davis engineers cleaned wells, installed new pumps, and added automatic controls.

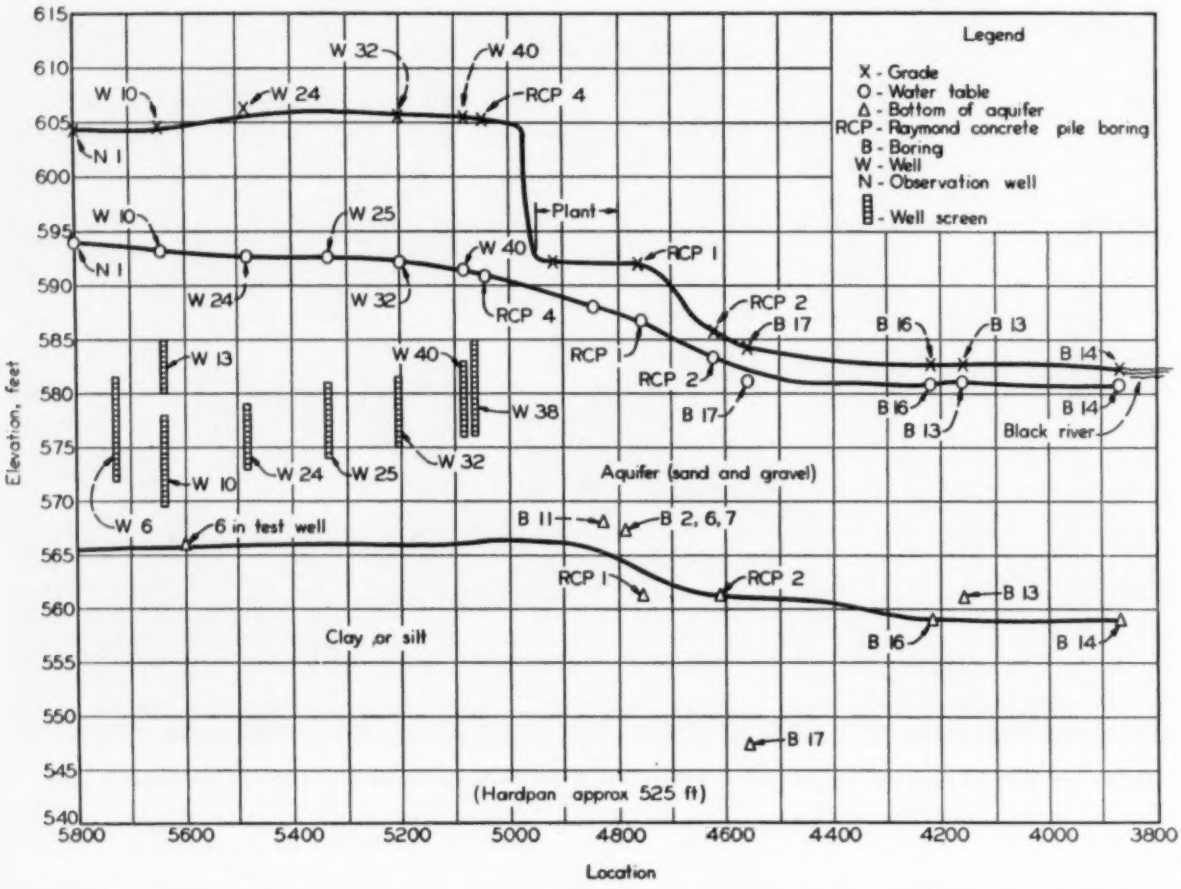
J. ADINOFF
Senior Chemical Engineer

PRELIMINARY SURVEY and analysis at the time of purchase of the site at Holland, Michigan indicated that sufficient quantities of well water could be pumped from the underground water strata in this region. While the previous pumping system had been basically a fill and draw operation which called for starting the well pumps only when the house water tank was low, records available on pumping rates indicated that Parke-Davis would be able to pump well water on a continuous basis and supply all plant requirements. These include water for potable, sanitary, boiler feed, equipment washing, and process uses as well as for special cooling applications in the plant.

The existing ground-water reservoir is of approximately 27-ft water saturated thickness. Water movement is in general from north to south, and undoubtedly empties into the Black River and Lake Macatawa. The ground water, at a uniform, year-around temperature of 55 F, occurs under water table conditions and is subject to the characteristics and physical laws of such strata. The piezometric surface of the aquifer is approximately 11 feet below land surface and follows, in general, the surface contours.

Character of Aquifer

There is little doubt that the surface sand in which the aquifer under consideration exists is a remnant of an earlier beach deposit. Below the sand there is a thickness of clay which persists to bedrock, which is either the coldwater shale or the lower Marshall sandstone, locally called "Waverly" stone. Borings, well logs, and electrical resistivity tests conducted at later dates did not determine the complete areal extent of the ground water reservoir in which the plant wells are placed. They did indicate, however, that the water table exists, in a quite uniform



Tests were conducted to provide data on the ground-water reservoir. Chart shows a typical profile section looking east.

depth, at least one-half mile to the north, a minimum of one-quarter mile to both the east and west, and empties into the river and lake to the south.

Existing Well System

The basic well water supply system available at the purchased plant site consisted of forty 5-inch well casings hooked up on two pumping systems. One group, called the North Field, consisted of 24 wells which were connected by two 6-inch headers into the suctions of a 1000-gpm, triplex, vertical piston pump. From this unit, an 8-inch diameter discharge line runs approximately 800 feet to an elevated well water tank which maintains constant pressure on the well water supply system to the plant.

In the South Field, 16 wells of identical construction were connected to a 500-gpm triplex pump. Both systems are of the suction-lift type where vacuum induced in the tight suction side of the pump and well casings is sufficient to induce a flow of well water into the pump casings for its positive discharge by pressure into the distribution lines.

Several factors inherent to such well water supply systems are not of the best and desired design. These can cause trouble and difficulties probably in excess of the problems encountered with a system where individual, vertical, turbine-style pumps are used. However, the speed of construction required for the new plant and the many design factors, then unknown, which would be required for the proper installation of a number of new, vertical turbine pumps necessitated the conversion of the existing system to an operating basis.

Well casings were all opened and examined for sediment, well-screen plugging, and general condition. Where necessary the brass screens were pulled and the saw-tooth slot openings cleaned manually of the siliceous deposits. In most cases baling, high pressure water jets, and acid cleaning were sufficient to put the wells in working order. A 50-hp motor with V-belt drive was connected to the triplex pump in the North Field, and the flow rate was slowed down to 800 gpm. After a thorough overhauling of the pump, the complete 24-well system was ready for operation.

New Pumping System

The South Field posed a problem in that the existing triplex pump was found to be in poor condition and it was believed uneconomical to attempt its repair. A rather novel pumping system was installed to replace the

discarded pump, as cost data indicated that a centrifugal pump installation would be more economical than another new, piston-style, positive displacement pump. A 30-hp, standard-fitted, horizontal, 500-gpm centrifugal pump was connected to the 8-inch suction header for the 16 wells. Then a 3-hp vacuum pump was connected to the suction volute of the new centrifugal pump to maintain the vacuum in the system and assure a continual, primed condition at the pump inlet. A 30-gal priming tank installed above the assembly is used as a level control to automatically start and stop the small unit which maintains the required vacuum. This installation has proven very successful and it is believed it offers many advantages in terms of installation and maintenance costs in comparison to a piston-style, positive displacement, type pump.

Automatic Pump Controls

Automatic control of the two pumps was achieved by the installation of an electric, multilevel, probe-style level control system in the elevated, house water tank. This system incorporates in its control the automatic operation of each pump according to a predetermined level in the tank, plus an automatic alternation of sequence of pump operation to maintain a fairly equal rate of drawdown on both north and south well fields. Automatic high level and low level controls will also ring alarms in the powerhouse at the master control panel board in addition to properly stopping or starting the pumps as required.

Examination of the system at the time of purchase revealed appreciable deposits in the piping. If this condition were allowed to continue, it would have materially reduced flow capacities and increased pumping costs. Therefore, to prevent deposition in the pipe lines of the iron present in the well water, a metaphosphate compound is introduced at the discharge side of each of the well water pumps to inhibit any ferrous ion precipitation. Automatic operation is achieved by having a small feed tank at the pump site and a single-stroke piston pump connected in parallel with the well pump starter box to assure operation of the feed pump at all times that well water is being pumped.

It also was found very effective to heavily chlorinate the old piping before using the well water system. This operation, besides accomplishing the decontamination of the old piping, induced a heavy flushing and removal of the sludge and rust accumulated in the system. If this material had been allowed to build up, it would have disrupted future operations by continually plugging valves, condensers, kettle jackets, process equipment, and the piping distribution system.

System Survey

While the system has proven adequate to furnish the required quantities

PHYSICAL DATA ON WELL ELEVATIONS

Well number	Top of 4 in. stub	Top of casing	Top of screen	Top of silt	Bottom of well	Top of block
North field						
1	601.06	606.49	581.28	572.91	572.68	606.74
2	600.68	605.18	583.14	574.56	574.43	605.74
3	600.44	603.45	579.06	570.70	570.43	605.46
4	600.56	603.07	579.41	571.26	571.15	604.82
5	601.58	604.11				605.65
6	601.21	603.75	581.24	572.59	572.51	604.93
7	601.55	607.68				607.95
8	601.29	605.83	580.75	572.33	572.18	606.76
9	600.76	603.96		574.72		604.71
10	600.51	603.88	578.26	569.63	569.64	604.84
11	600.16	602.86	577.34	568.75	568.64	604.27
12	601.27	603.99	582.53		573.76	604.83
13	603.27	608.50	585.08	577.58	577.44	610.35
14		606.17	579.46	572.90	572.75	606.63
15		606.24	580.37	573.41	572.97	607.77
16	600.58	605.64		576.85		606.19
17	600.51	604.05	579.30	570.76	570.68	606.12
18	600.91	604.95	579.11	570.51	570.39	606.03
19		607.93	583.24	577.20	577.00	609.46
20		607.60	583.60	577.02	576.96	609.01
21		606.04		591.46		608.02
22		605.89	580.39		573.78	607.09
23	600.79	605.29	580.77		573.94	606.40
24	600.18	605.05	578.99		573.26	606.77
South field						
25		613.19	581.01		574.34	*592.94
32		605.94	581.45		574.95	*592.56
34		603.90	581.39		574.51	*592.22
38		603.06	585.73		576.88	*591.88
40		605.86	582.75		575.89	*582.75

*Values shown are water levels.

North field elevations obtained July 1951. South field elevations obtained December 1951.

of well water for the new plant, it was recognized that a program to study the entire well water supply system would be desirable if a true picture of the problem were to be attained. A project, started in the fall of 1951, has been exploring this problem on the following basis:

1. Pumping tests, conducted in cooperation with the Geological Survey Division of the Department of Conservation, were run for a week on a 6-inch well installed for the tests. During this period, a constant amount of water was removed from the ground water strata continuously and passed through a line which discharged into the plant sewer system and then into the Black River. In this way a definite quantitive amount of water was pumped out of the field.

Data obtained from these tests were used to calculate the coefficient of storage, coefficient of transmissibility, and to detect any definite "boundaries" of the water bearing strata. These results show that a conservative value of the coefficient of transmissibility is approximately 30,000 gpd per ft and the coefficient of storage is approximately 0.11.

2. Borings in the area, plus the results of electrical resistivity tests conducted by a consulting firm, were used to obtain an accurate appraisal of the depth, areal extent, and characteristics of the water table, and a clearer picture regarding the topography and geological and physical nature of the land itself.

3. Accurate records are being kept by the plant operating personnel in regard to current well water consumption and drawdowns of the reservoir. These data, plus tabulation of monthly rates of precipitation, are being continually reviewed and interpreted in relationship to the information obtained from the other described sources.

Evaluating pumping capacities which can be drawn from ground-water reservoirs is relatively difficult. It must be assumed that the pumps will remove water from storage continuously, and during any particular drought period the drawdown cone develops until the rate of flow from rainfall and ground water into the drainage equals the rate of withdrawal. This basis of design was used when calculating pumping capacities.

Basically, the batch process operations of the plant require only a comparatively small amount of well water as the major portion of the demand is for cooling purposes. For this reason and with the complete availability of both service and well water piping throughout the processing areas it is possible to furnish river water for cooling purposes in the seven or eight months that the river water is as cold or colder than well water. Only minimum effort is required to make the necessary changeover from well water to service water and back. This allows considerable flexibility in the operation of the well water supply system.

TYPICAL ESTIMATE OF HOLLAND PLANT WELL WATER CONSUMPTION

Use	Peak rate gpm	Maximum weekly requirement	Maximum weekly total gallons
Isopropanol evaporation	28	15 hours	25,200
Isopropanol evaporation	120	17 hours	122,400
Ethyl acetate recovery	15	17 hours	15,300
Ethyl acetate recovery	15	17 hours	15,300
Recovery plant	122	28 hours	205,000
Boiler feedwater	50		100,000
Processing department cleaning	20		20,000
Processing	25	27,000 gal	27,000
Flake ice manufacturing	2	26,000 gal	26,000
Potable and sanitary	30		22,500
Total	427		578,700

ESTIMATED PUMPING CAPACITIES OF EXISTING WELL SYSTEMS

System number	Days drought	Drawdown limit feet	Calculated drawdown feet	Pumping* rate gpm	Total** capacity gpm
1. Existing south field	180	6.5	6.3	80	
Existing north field	180	7.5	7.1	156	236
2. Existing south field	100	6.5	6.7	96	
Existing north field	100	7.5	7.1	192	288
3. Existing south field	100	6.5	7.0	88	
Existing north field (10 lowest wells only)	100	12.0	11.4	240	328

*Continuous pumping, 24 hours per day, 7 days per week
**When operated simultaneously

Survey Benefits

It is believed that the program has yielded valuable factual data. This information will be the basis of design for a new well water supply system when the present installation needs replacement or modification, due either to deterioration of the existing system or increased supply demands beyond the range of the present installation. It is very evident that the survey will pay dividends in both economy of installation and maximum utilization of the water table (a problem which most well water installations do not properly meet). Furthermore, the data will enable the engineering department to accurately predict for management what can be expected from the well water system in regard to future quantities available for production.

Restoring Battery Electrolyte...

Preparing the electrolyte for replenishing lead-acid batteries requires careful consideration of temperatures and dilutions.

LEAD-ACID storage batteries may lose their electrolyte on account of leaks, spills or overflows; electrolyte can also be lost during battery repairs. In such cases, electrolyte of proper specific gravity must be restored.

Most manufacturers of sulfuric acid market a type specifically for making up storage battery electrolytes. These acids are available in concentrations of 1.835 sp gr and 1.400 sp gr. The acid is added to pure water—never water to acid—a little at a time according to the ratios as given in the adjoining table.

Temperature Corrections

Specific gravity is affected by temperature since the electrolyte expands as it gets warmer. Due to the reduced density, the hydrometer bulb rides lower in the electrolyte as the temperature rises. Therefore, the specific gravity as measured by the hydrometer must be increased when the electrolyte is warmer than the 77 F base temperature used in the table.

The actual temperature correction is made on the basis that the electrolyte specific gravity changes three points for every ten-degree change in electrolyte temperature. Accordingly, for electrolyte specific gravity measured at an electrolyte temperature of 87 F, the apparent hydrometer reading should be increased 3 points to give the actual specific gravity. Conversely, 3 points should be deducted from the apparent hydrometer reading if the electrolyte were at 67 F when measured; proportional corrections are thus made for all deviations from the base temperature.

Another temperature factor to be watched is the heat resulting from the mixing of electrolytes. When battery acid is being reduced to the proper specific gravity by dilution with water, the entire mixture becomes warm. The newly-mixed electrolyte should be cooled below 100 F before adding to the battery to prevent cell injury.

To restore slight decreases from normal specific gravity — 15 points or less — acid of 1.300 sp gr may be added over a period of time until the electrolyte is back to its normal density.

When the specific gravity is to be raised more than 15 points, some of the electrolyte must be removed from the cells and replaced with 1.400 sp gr acid. The cell should be charging at the finishing rate when acid is being added so that evolved gases are available to mix the acid with the liquid already in the cell. To thoroughly mix the liquids in the cell, the battery should be charged for one hour.

Evaporation

Evaporation of the water in the electrolyte is usually slight but electrolytic decomposition can take place. This may be indicated by excessive gassing. Loss of water results in greater acid concentrations.

The fully charged battery should never be allowed to have electrolyte specific gravity greater than 1.310. Such high concentrations are injurious to the cells. Pure water should be added to reduce the specific gravity.

WATER-ACID MIXTURES REQUIRED TO OBTAIN ELECTROLYTE OF VARIOUS SPECIFIC GRAVITIES

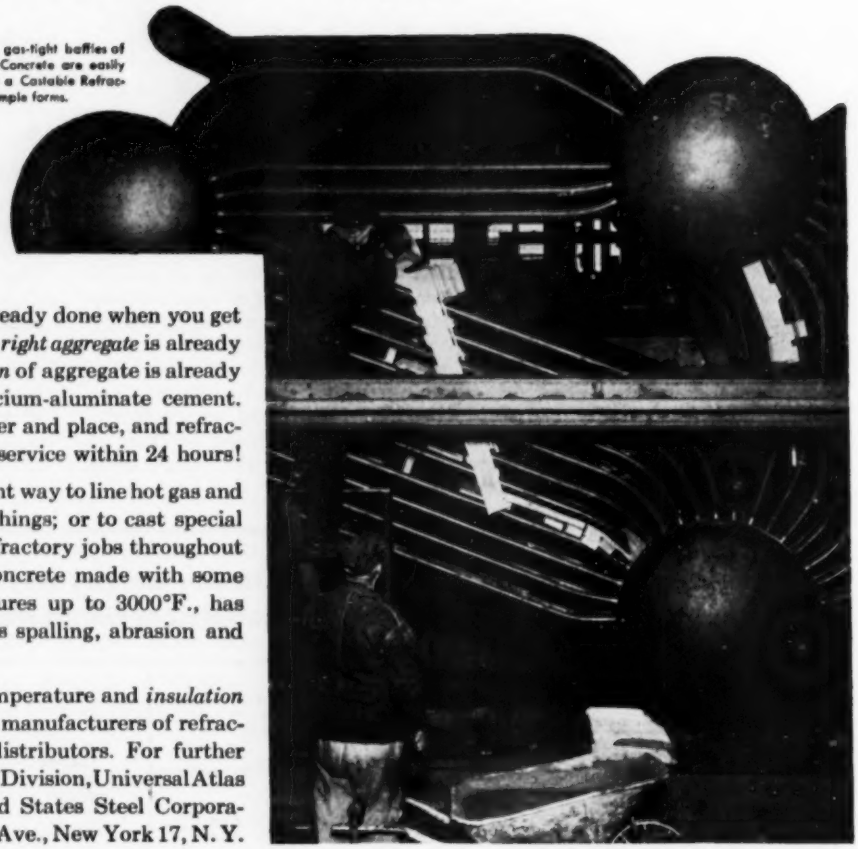
When mixing by volume using 1.835 sp gr acid		Specific gravity desired 77 F	When mixing by volume using 1.400 sp gr acid	
Parts water required	Part acid required		Parts water required	Part acid required
1.78	1	1.375	.075	1
1.86	1	1.365	.11	1
1.94	1	1.355	.14	1
1.975	1	1.350	.16	1
2.08	1	1.340	.20	1
2.17	1	1.330	.24	1
2.22	1	1.325	.27	1
2.33	1	1.315	.31	1
2.42	1	1.310	.33	1
2.52	1	1.300	.38	1
2.65	1	1.290	.43	1
2.70	1	1.285	.46	1
2.79	1	1.280	.49	1
2.84	1	1.275	.53	1
2.92	1	1.270	.56	1
3.10	1	1.260	.63	1
3.18	1	1.255	.67	1
3.26	1	1.250	.70	1
3.38	1	1.245	.74	1
3.46	1	1.240	.78	1
3.67	1	1.230	.85	1
3.80	1	1.225	.905	1
3.91	1	1.220	.96	1
4.03	1	1.215	1.00	1
4.15	1	1.210	1.05	1
4.26	1	1.205	1.11	1
4.43	1	1.200	1.16	1

Find the specific gravity desired in center column—for acid of 1.835 sp gr, use figures on the left; use right-hand columns for 1.400 sp gr acid.

Gould-National Batteries, Inc.

CASTABLES give you a head start on your next Refractory job

Monolithic, gas-tight baffles of Refractory Concrete are easily made with a Castable Refractory and simple forms.

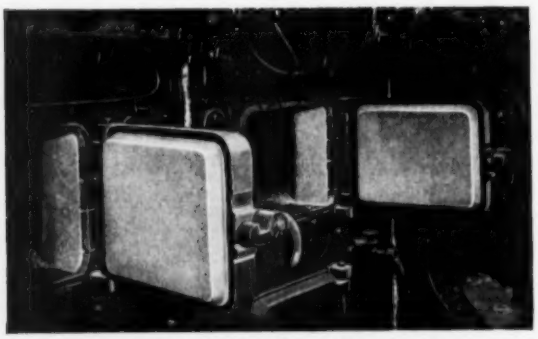


TWO PARTS OF THE JOB are already done when you get Castable Refractories. The *right aggregate* is already selected. The *right gradation* of aggregate is already mixed with Lumnite* calcium-aluminate cement. All you do is mix with water and place, and refractory concrete is ready for service within 24 hours!

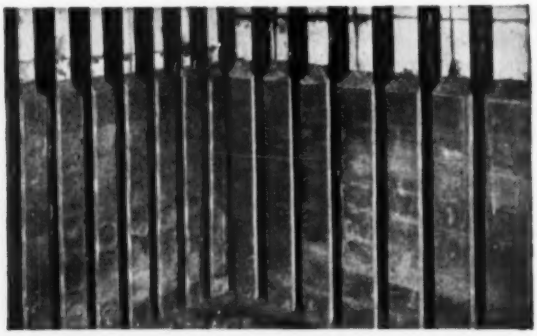
That's the fast, convenient way to line hot gas and air ducts, stacks and breechings; or to cast special shapes . . . and do many refractory jobs throughout your plant. Refractory Concrete made with some Castables takes temperatures up to 3000°F., has low volume change, resists spalling, abrasion and corrosion.

CASTABLES to meet specific temperature and *insulation* requirements are made by manufacturers of refractories and sold by their distributors. For further information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Ave., New York 17, N. Y.

Packaged Castables used in these jobs were made by Mexico Refractories Company, Mexico, Mo.



DOOR LININGS made with adaptable Castable Refractory Concrete. Unnecessary to stock large inventories of special shapes. Instead, special shapes can be cast in place or poured in molds as needed. Volume change is negligible.



TUBE PROTECTING Water Wall Studding made with a Castable Refractory is tough and highly radiant, uses a different aggregate than baffles (above). With Castables you get Refractory Concrete tailor-made for the job.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

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ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

Selection and Application of Apparatus and Control Cable

APPARATUS CABLE is used for making connections to transformers, motors, motor-generators, generators, brush holders, switchgear, portable machinery, appliances, and equipment. It is chosen for such qualities as dependability, ease in handling, flexibility, and resistance to oils, acids, and alkalies. Flexibility is desirable for connection in terminal boxes and because apparatus usually requires leeway of movement, if only occasionally. On test floors, good flexibility is essential.

Apparatus cable usually is made only in the single conductor type.

Stranding and Separators

Annealed conductors can be furnished in any suitable standard stranding. Classes G and H are normal for flexible apparatus cables; classes C and D may be sufficiently flexible for many uses.

Wires are tinned or special-alloy coated, when required, for cables having insulations such as rubber and varnished cambric, and for others when requested.

To provide greater flexibility and ease in preparing cable ends, separators sometimes are used on rubber insulated conductors, especially for motor and transformer loads. These consist of a thin paper or cotton wrap over the conductor, providing full coverage. It prevents the insulation from adhering to the conductor. Free stripping compounds, such as vinyl resins, may be used without separators.

Insulations

Insulations may be used as noted in Table 1. Selection is made to suit the service required and for the temperatures encountered. The latter should include the manufacturing cycle for all equipment with leads attached.

Rubber and neoprene insulated cables are used for motor leads.

Varnished cambric cables are used for connections to motors, generators, circuit breakers and a brush holder leads as well as transformer leads under some conditions.

Asbestos is used to a considerable extent for leads to or within apparatus such as rheostats. Asbestos-varnished cambric insulation is used up to 5 kv for power conductors to and in equipment requiring higher permissible operating temperatures than varnished cambric allows.

Coverings

Coverings are also listed in Table 1. Varnish treated braids are used on varnished cambric cables exposed to transformer oil, and are heat and oil resistant, as are lacquered braids over rubber insulated cables.

Neoprene insulated and neoprene covered cables are excellent for motor leads, coils, transformers, ballasts, and other applications where baking effects are severe. This is true because neoprene is resistant to so many exposures including oils, acids, alkalies, gasoline, fumes, moisture, and greases, as well as heat. Its use should be considered for such applications.

Thermoplastic insulated wires are excellent for equipment and appliances because of their high operating temperature and resistance to moisture and other deteriorants.

TABLE 1 — TYPICAL APPARATUS CABLES

Application	Insulation	Outer covering for 600 v	Saturant and finish	Maximum copper temperature, C dry	Maximum copper temperature, C in oil	Remarks
	Triple cotton braid		Varnish	90	60	Resists heat, oil. For small motors, etc.
	Type R rubber	Cotton braid	MRFR*	60		Weatherproof covering
Small equipment	Type RH rubber	Cotton braid	Lacquer	75		Heat and oil resistant
	Type RH rubber	Cotton braid	MRFR	75		Weatherproof covering
	Neoprene	Cotton braid	MRFR	60		
	Neoprene	None	None	60		Paper over tinned wire for motor leads
	Type RH rubber	Neoprene	None	75		
	Thermoplastic	None	None	80	60	Types TF and TFF fixture wire
	Thermoplastic	None	None	105		Appliances. Concentric or bunch stranded
	Varnished-cambric	Cotton braid, 1 or 2	SB**	85		Coated conductor
Small and large equipment	Varnished-cambric	Cotton braid	Varnish	85		Coated conductor
	Asbestos-var. cambric	Asbestos braid	HF***	110		Underwriters' Type AVA
	Asbestos-var. cambric	Cotton braid	MRFR	90		Underwriters' Type AVB
	Asbestos	None		200		Underwriters' Type A
	Asbestos	Asbestos braid	HF***	200		Underwriters' Type AA
	Impregnated asbestos	None		125		Underwriters' Type AI
	Impregnated asbestos	Asbestos braid	HF***	125		Underwriters' Type AIA

*Moisture resistant, flame retardant. **Smooth black. ***Heat, moisture and flame resistant.

. . . Control Cables

CONTROL CABLES may be considered the nerves of any electrical system. So many operations and so much safety depend on them that, first of all, they must be reliable to a high degree.

The distinctive feature of control cables, as distinguished from power cables, is that only a small amount of current or energy is transmitted and even a small amount of leakage current might be serious in some circuits.

Control cables are used for duct, aerial, and direct burial installations in many types of service including power stations, substations, traffic, railway train control, grade crossings, tank farms, steel mills, and many others.

Choice of insulation and protective coverings must be so made that the cable will be suitable for its particular installation conditions and have the high reliability and long life demanded. Other characteristics usually are based on convenience, economy, and ease of handling.

Construction

Control cables generally are manufactured with rubber, thermoplastic, varnished cambric, or asbestos, and varnished cambric insulation.

Rubber is common because it is moisture resistant, flexible, reliable, and easy to handle. The cables usually come with tinned, stranded conductors having 19 No. 22 Awg, or 19 No. 25 Awg wires, approximately equivalent to Nos. 9 and 12 Awg solid wire, respectively. Performance grade insulation, or better commonly is used with a color coded braid over the individual conductor and rubber filled tape over the assembled conductors. Special cold process rubber compounds are recommended for control cables because they are proven, long aging materials and are both heat and moisture resistant.

Thermoplastic (vinyl resin or polyethylene) insulated and jacketed control cables also are reliable, flexible, economical, and easy to handle. They are practically impervious to moisture and to most oils, acids, and alkalies. These cables usually have a thermoplastic jacket for all ordinary uses. They are recommended on shipboard and in steel mills where their characteristics are desirable. Thermoplastic insulated and jacketed control cables are widely used on installations subject to floods.

Polyethylene insulated vinyl resin jacketed cables in twisted pairs and quads, with or without individual shielding and with or without shielding over the assembly, are available for communication circuits. Polyethylene is used because of its low specific inductive capacity (SIC). For more complete details on communication wire and cable, see the manufacturers' literature.

Moisture wicking along the braid can be eliminated by applying a thin wall of colored neoprene over the individual rubber insulation in lieu of the braid.

Varnished cambric insulation, usually with lead sheath, is preferred by some industries such as steel mills. It is durable, long lasting, and reliable but more expensive. The sheath, of course, is impervious to moisture but the insulation itself is not. Varnished cambric insulated cables with a braid cover are satisfactory in permanently dry locations.

Fillers

In general, dry jute fillers are used for rubber insulated control cables when a lead sheath is required, paraffin saturated jute fillers for cables having outer braid covering, and rubber fillers for cables having a braid or rubber jacket outer covering and where resistance to moisture absorption is important. For thermoplastic insulated control cables, treated jute or treated glass fibre fillers are recommended.

Identification

Usually, a cotton or rayon braid is placed over each individual conductor insulation for purposes of mechanical protection and identification. Standard procedure in the industry has been to use a base color and colored threads in the braid so that each conductor may readily be identified. The scheme of color identification (coding) and the standard colors in use are available in manufacturers' literature.

In some cases, especially where large size control cables are required, use of an individual braid over each conductor insulation results in too large a diameter for economy or convenience. In such cases, the braid is omitted and identification can be achieved either by a raised tracer in the rubber insulation or by taping over the insulation, with one such tracer in each concentric layer of conductors.

Where there are over six conductors in a cable, solid color neoprene jackets over the individual conductors may be repeated or permanent tracer stripes painted over the base colors.

Thermoplastic control cables are identified in the same manner, excepting that striped tracers are usual instead of repeating the solid colors.

Outer Protective Coverings

The standard procedure for braids over the assembled conductors of the cable is to use an ASTM standard braid for indoor service and installation in conduit, and an ASTM heavy braid for outdoor and rough service. Two braids may be applied where the service demands it. Braids are saturated and finished in accordance with standard practice.

Lead sheath is applied over rubber and varnished cambric insulated control cables in accordance with IPCEA Specification S-19-91 for power cables.

For protective coverings, all the conventional types are available and are in general use. These include nonmetallic sheathed cable (neoprene compounds) for aerial, conduit or direct burial installations, interlocked metallic or parkway armored cables for direct burial, and wire armored cables for submarine service. Several protective coverings over lead sheathed cables are available.

The first requirement for station cables is reliability because continuity of operation is essential. Hence careful attention must be paid to proper design and installation details.

Station cables include those used for steam, hydroelectric, and diesel power stations, indoor and outdoor sub-stations, and similar projects for these and other purposes:

Main generator leads
Exciter leads
Motor-driven auxiliary cables
Control cables
Bus connections
Power transformer leads
Cables to substations
Outdoor cable connections

These are essentially power cables so designed as to conductors, insulation, and coverings to meet the above requirements.

Because of restricted space, lead sheath introduces complications but is often unavoidable as in paper-insulated cable and varnished-cambric-insulated cable in moist locations.

High-temperature insulations (75 C and higher) are favored as they carry more current, allow of more compact design, simplify initial and replacement cable requirements, and save space and costs of conduit and pans.

Coverings require careful consideration. In some cases, such as run to outdoor substations, one cable may be installed on metallic pans, in conduit, and directly in earth.

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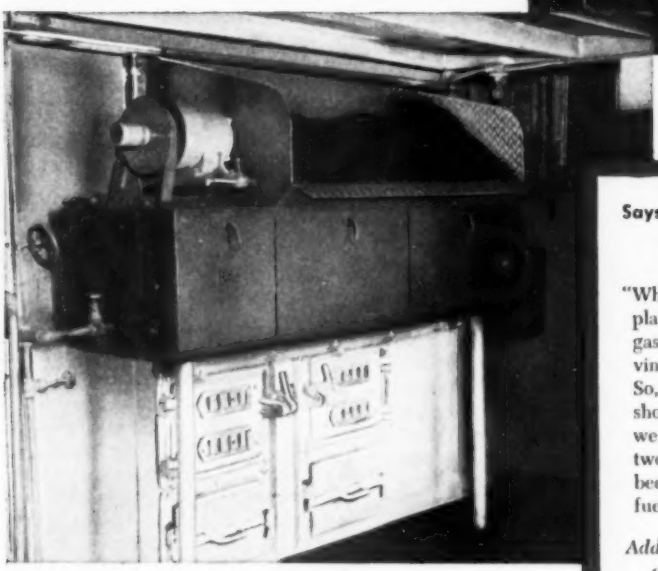
"OUR BEST BET WAS COAL

and with new equipment we cut our steam costs OVER 60%"

An air view of the Metcalfe Wholesale Florist Greenhouse.



Says John O. Metcalfe
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"When we remodeled our heating plant, we considered all fuels—coal, gas, oil. A careful fuel survey convinced us that our best bet was coal. So, we installed the new equipment shown at left. We are glad today that we did so. We have cut costs by two-thirds. Our labor savings have been nothing short of remarkable . . . fuel savings average $300 per month."

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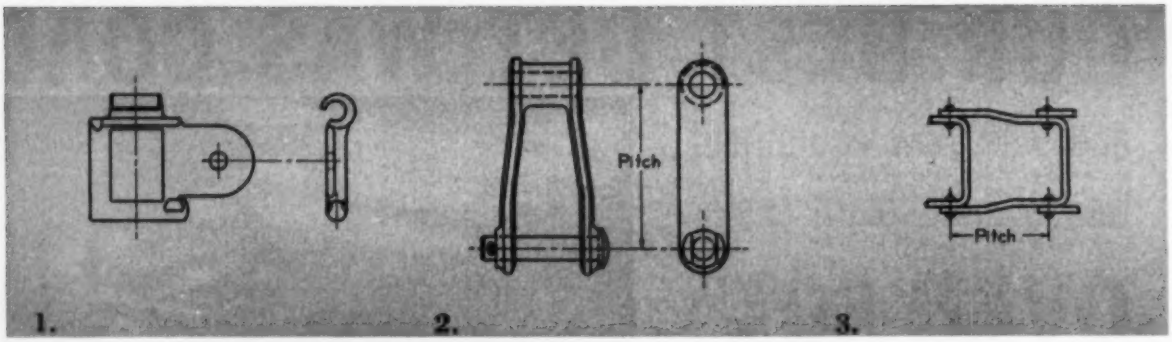


Five types of conveyor chains are shown in these drawings: 1, a Ewart detachable chain, usually used for light conveyor drives; 2, Pintle chains use barrels instead of hooks and will handle heavier loads and can have longer

Chains for Conveyors

WILBUR G. HUDSON

Consulting Engineer

STANDARDIZED CHAINS available for conveyors, elevators, and drives have certain advantages and certain limitations which must receive careful consideration when designing material handling installations. Chains range from the stamped steel detachable link belts for light service to the heavy duty, engineered designs that permit interchangeable replacement of parts when worn.

Rivetless chains are perhaps the most widely employed because of their adaptability to various conditions and their low cost. Unfortunately, one unique feature has trouble possibilities—this chain is collapsible. On one installation—an extremely long, slightly inclined conveyor—the twin chains parted occasionally when the loaded conveyor was started after an emergency stop. This occurred even though the ultimate strength rating was far beyond the estimated working load. Examination disclosed that when the motor was stopped, the elasticity of the chains caused the head shaft and sprockets to reverse a turn or two, backing off adjacent links. This caused the chains to snap together and break when restarting. A solenoid brake ended the difficulty.

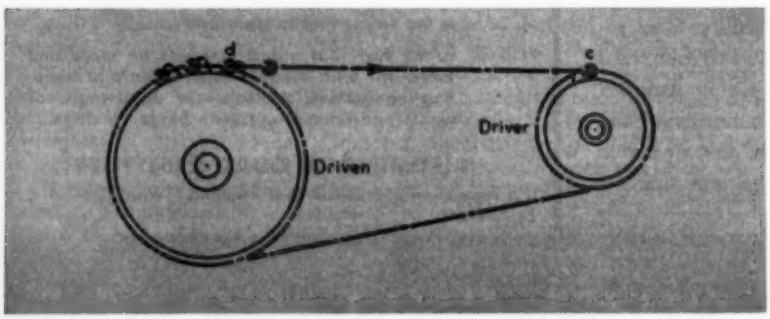
Heaviest wear of conveyor and elevator chains occurs where the chain passes around the drive sprocket. Some chains are uni-directional, that is the wear is much less if run in the proper direction. For example, if the Ewart or Pintle chain is run with the barrel-end leading, the barrel of each link rubs against the drive sprocket tooth, and the tooth is worn into a hook which eventually snags the chain. When run with the bar or wide-end leading, there is no rotation between the barrel and tooth, and articulation occurs primarily between the pin and barrel where the contacting surfaces are supposed to be lubricated.

However, when the chain is to operate as a drive, it is best to run the chain barrel-end leading, and the diagram below shows why. At point c, where the link entering the drive sprocket does the work, the barrel slips down the face of the tooth, but the tooth wear is evenly distributed and no hook is formed. At the driven wheel, the releasing tooth, d, does all the work. The barrel rests against the tooth and releases as the chain straightens in moving toward the driver.

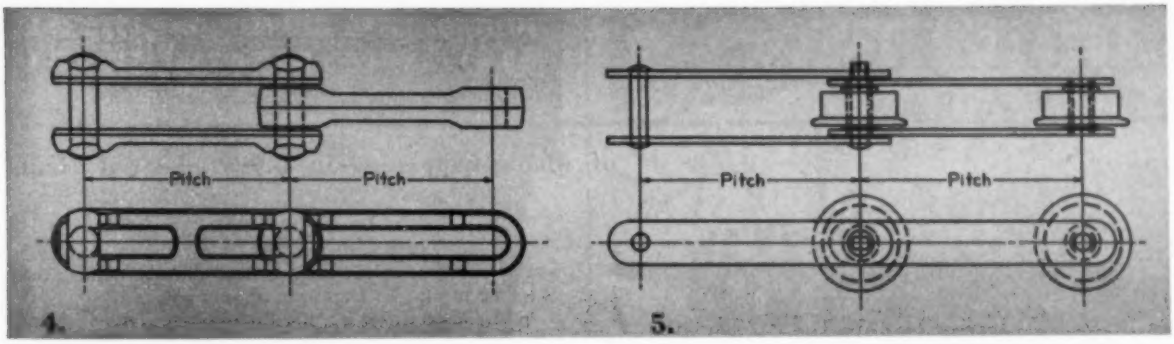
Some years ago the U. S. Army Corps of Engineers were called upon to make recommendations on the extremely heavy lifting chains used to operate the massive flood gates controlling the water level of a dam. When the gate is down the chains are submerged, so lubrication is impossible. They had to determine a contacting metal which would not gall as the chain articulated.

Galling, however, is an actual tearing of the metal, due possibly to atomic seizure of two metals with the same or similar characteristics. This cannot occur if there is even the minimum of lubricant present. Galling must be distinguished from abrasion, which occurs when a grinding agent, such as some pulverized hard material, works into the joint. The test procedure adopted was to suspend a chain bar between the holding bars in a tension machine and rotate the cleansed chain pin through an arc of 70 deg under increasing loads until galling occurred.

It was found that none of the alloy-steel combinations could stand pres-



Ewart chains operating as drives should be run with the hook end leading.



pitch; 3, Refuse chains are used for conveyors of light, non-abrasive materials; 4, Rivetless chains are detachable and pins can be reversed; 5, Engineering chains are for heavy-duty, long-life service on conveyors.

sures greater than 6000 psi. However, a thin cadmium plating (0.0003 in.) had the effect of a lubricant, and it prevented galling at pressures to the limit of the machine (25,000 psi), with metals which otherwise galled at 1000 psi. Even after the plating had been ground into the pin it inhibited galling to a certain extent. Nitrided or aerocased pins with SAE 1045 bars withstood a much higher bearing pressure than alloy-steel bars. A bronze bushing prevented galling up to the limit of the machine.

Their findings agreed with those secured by one of the chain manufacturers in laboratory tests in which pins of 0.25 in. diam were rotated under water at 120 rpm with a split bushing used as a bearing. An ammeter in the motor circuit indicated when galling occurred. Their results are shown in Table 1.

Hard-Soft Bearing

A test was made with a combination of a nitrided pin (1000 Brinell) in an untreated 1020 bushing with loading up to 19,000 psi without galling either the hard pin or the very soft bushing. This confirms the old rule—of two bearing surfaces, one should be as hard as possible.

Consider this with reference to the rivetless chains. Pins and links are of drop-forged steel, which has a limit of steel against steel of about 3000 psi. The 6 in. pitch chain has an ultimate strength of 100,000 psi. With the usual safety factor of six it might be assumed as suitable for a working load of 17,000 psi. If the pin has a bearing area of 1.75 sq in. in the center link, the pressure on the projected area would then be 9700 psi. Working backward, the safe loading actually is 3000 x 1.75, or about 5200 psi, and it is advisable to keep within this figure.

A frequent factor encountered, especially in conveyors handling food products, is corrosion. The chain may be required to function in contact with organic or inorganic acids. Malleable iron has greater resistance to corrosion than steel. However, in one installation handling hot brewers grains, the lactic acid content seriously corroded the malleable iron chain of a continuous flow elevator within a few months, while the sheet steel casing was unaffected. A stainless steel chain would have been better, but it was decided that occasional replacement of the malleable chain would be cheaper. Serious corrosion occurred also in the chain of a conveyor handling stockyard wet bone scrap.

High Temperature

Another less frequent requirement is resistance to high temperature as in annealing ovens. Cadmium is out since the metal melts at 610 F. A nickel-cadmium bearing metal containing about 3 per cent nickel has a tensile strength of only 600 psi at 572 F, as contrasted with 14,000 psi at room temperature. However, standard heat-resistant alloys are available, and the chain should have loose joints to permit free movement. A good composition is 35 per cent chrome and 15 per cent nickel in contact with a component of 15 per cent chrome and 35 per cent nickel.

A recent development destined to have wide applications in materials handling chains and other parts is Ductile Cast Iron. It consists of a perlite and ferrite matrix with graphite present in the form of spheroids. This iron is produced by treatment of a grey iron base with small amounts of magnesium, which serves to convert the flake type graphite to a spheroidal form while in the molten state. The graphite remains spheroidal upon solidification. In the as-cast condition, tensile strengths of 85,000 to 95,000 psi are obtained with a yield point of 75,000 psi and an elongation of 2 to 5 per cent. Short cycle annealing will develop tensile strengths of 60,000 to 75,000 psi with yield strength of 50,000 psi and 15 to 18 per cent elongation. In the annealed condition machining properties superior to grey iron are obtained. This material, either as-cast or in the heat-treated condition, has great possibilities and in some instances is replacing bronzes and brasses where non-sparking qualities are not involved.

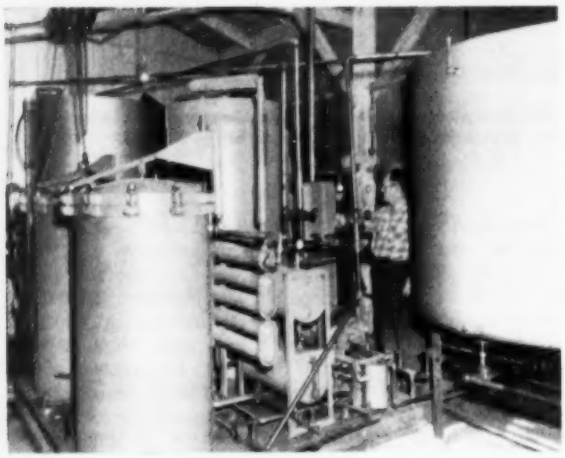
TABLE 1 — RESULTS OF GALLING TESTS

Bushing		Pin		Bearing load failure, psi	Condition of bearing
Steel	Brinell	Steel	Brinell		
3140	350	3245	512	11,040	Slight galling
1040	180	1040	258	7,200	Galled
3140	400	3245	500	13,800	No galling
1040	250	1040	250	9,000	Galled
3140	300	3245*	512	18,000	No galling
1040	300	3245*	512	14,000	No galling

* Cadmium plated

spot news

of what's happening in U. S. industrial plants



Reclaimer Cuts Cincinnati Utility's Cost of Transformer Oil

Use of an oil reclaimer for purifying transformer oil is expected to reduce Cincinnati Gas & Electric Company's oil bill about $4000 annually. The unit is producing transformer oil with characteristics, in many respects, equal to those found in new oil.

The Cincinnati utility installed a Hilco model 200 Duplex Oil Reclaimer in July 1951, as part of a newly developed program of transformer maintenance. Formerly, oil drained from transformers brought into the shop for servicing was reclaimed by removing water with a centrifuge and reducing the acid content to a neutralization number of .75. Oil which was considered to be too contaminated for reclaiming was sent to the Gas Department of the utility for production of propane gas.

In one operation, the Hilco unit removes water and reduces acid content from a neutralization number of .9 to a value of .05. Oil with a higher neutralization number than .9 is sold to the Gas Dept. for 10¢ per gal.

In the first three months of operation, the reclaimer processed 12,650 gal of transformer oil at a cost, including labor, material, and amortization, of $1075.62. Per gallon, this amounts to 8.5¢. If purchased new at the present price of approximately 34¢ per gal, this quantity of oil would cost $4301. Since the oil was formerly sold to the Gas Dept., the amount of $1265 which could have been obtained by selling it must be subtracted from the indicated savings.

The reclaimer is actually a miniature refinery, and its principle of operation is similar to that of a cracking coil or pipe still. Contaminated oil is pumped into the unit through a heat exchanger which is heated by the outgoing clean oil. It is then filtered through water-resistant Fuller's earth, and heated in a vaccum. The vacuum provides a means for removal of moisture and other volatile impurities having a lower boiling point than oil. These impurities are condensed in a distillate tank and drained to the sewer. Before being pumped to the clean oil storage tanks the hot purified oil is passed through the heat exchanger to warm incoming contaminated oil.

The Cover — Parke-Davis

Producing high-grade pharmaceuticals takes a lot of process equipment. The advent of the wonder drugs only heightened the importance of process controls, containers, and transfer lines. When Parke-Davis found the demand for their chloromycetin steadily climbing, they acquired an existing plant to house facilities for increased production needed.

Most of the process equipment is multiple-floor level with control stations at many intermediate points. The cover shows one of several stations with its maze of valves, indicators, and switches, typical of closely monitored chemical production.

New Facility Doubles Manufacturer's Generator Production Capacity

Continuing growth of the electric utility industry has called for increased production of generating apparatus, both in numbers and in unit sizes. To meet this need, Westinghouse Electric Corp. reports that an expansion program now being completed at the East Pittsburgh Works of the Transportation and Generator Div., will nearly double the company's capacity for the production of generators and large motors.

Heart of the expansion program, which was launched in 1950, is a 100,000 sq ft building that parallels the previous manufacturing aisle. Waterwheel generators, and turbine generators larger than 60,000 kw, will be machined in the

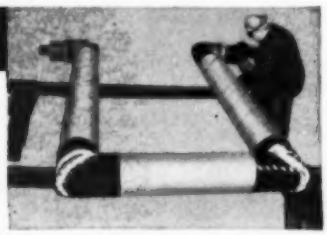
(Continued on page 100)

THE BEST ENGINEERING SPECIFICATION FOR INSULATED PIPE LINES

COMPLETE PROTECTION

Ric-wiL HEL-COR Units are designed for severe service conditions. The strong, shock-proof housing is 16-gauge Armco ingot iron, spirally-corrugated, hot-dipped galvanized, and rust-proofed "Bonderized." Outside is given a ⅛" thick covering of high-melting point asphalt and asbestos felt, and inside coated with phenolic resin, baked-on — a multiple layer of protection against moisture and corrosion.

CERTIFIED WELDING



Built by skilled craftsmen, all Ric-wiL systems are designed and welded to comply with the requirements of the A. S. M. E. Code for Pressure Piping, and we are authorized to apply the appropriate Code symbols. Piping and conduit are rigidly inspected and tested before leaving our factory — your assurance of trouble-free piping performance.

PREFABRICATED UNITS

All parts and fittings, including complete expansion loops or packless-type joints, are delivered to job site in easily-handled units of sound engineering design — eliminating many installation steps entirely and lowering final costs. These versatile units may be safely installed under city streets, railroad tracks, or suspended overhead.

Ric-wiL Systems range in size from 6" conduits to giant 84" diameter Utilidors designed to carry all utility services. Put Ric-wiL's broad experience to work for you — ask us for latest literature or discuss your next piping project with a Ric-wiL representative.

THE RIC-WIL COMPANY
Mfgrs. Insulated Piping and Conduit Systems
UNION COMMERCE BLDG. • CLEVELAND, OHIO

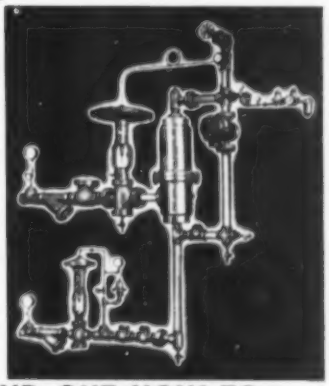
LEADERS IN INSULATED PIPING PROTECTION

Booklet with the ANSWERS TO YOUR HOT WATER PROBLEMS! NO OBLIGATION

Get the Facts About the Sensational

Pick INSTANTANEOUS WATER HEATERS

Industries all over America are finding Pick Heaters the money-saving answer to their hot water problems. Water is heated INSTANTLY by steam injection to exact temperature desired and in volume needed. Easy to install — no storage tanks required.



FIND OUT HOW TO CUT HOT WATER COSTS...

. . . MAIL THIS COUPON TODAY!

Pick Manufacturing Co., Dept. 300
West Bend, Wisconsin

Without obligation send your booklet on how Pick Heaters cut costs of hot water used for purpose checked.

☐ PRODUCTION ☐ WASHUP ☐ SHOWERS

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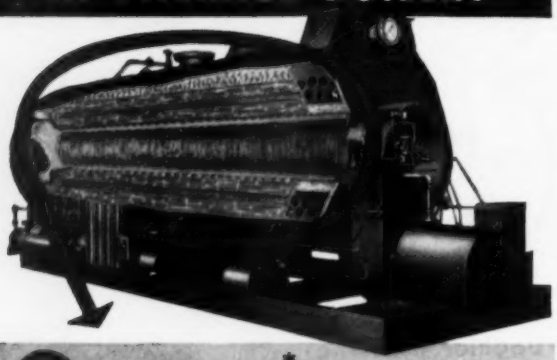
THE BIG DIFFERENCE IN PACKAGE BOILERS



CYCLOTHERM* CYCLONIC COMBUSTION gives you 66% MORE POWER per sq. ft. of heating surface

The cyclonic action of the flame revolves evenly in a free spiraling vortex the full length of the furnace and provides an even rate of heat transfer throughout the entire length of the combustion chamber.

This controlled combustion reduces heating surface requirements from 5 to just 3 sq. ft. per B. H. P. giving 66% more power.

Plus These Important Features

- Saves up to ⅓ the Space of Conventional Package Units
- Guaranteed 80% Minimum Efficiency
- No Hot Spots or Flame Impingements
- Burns Oil, Gas or Both
- Savings up to 50% on Maintenance
- No Expensive Stacks or Foundations to Build
- Greater Fuel Savings

And That's Not All . . .

Cyclotherm Steam Generators with *patented* Cyclotherm Cyclonic Combustion gives you: Full power operation from a cold start in 15 to 20 minutes; Built in accordance with A.S.M.E. and Nat'l. Board Standards and bears the label of Underwriters Laboratories Inc.; Complete range of sizes from 18 to 500 h.p., 15 to 200 psi operation pressure.

WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm" and find out why Cyclotherm Steam Generators have been proven superior in thousands of installations. Just drop a post card to Cyclotherm, Dept. 38 Oswego, New York.

*Reg. trade name

CYCLOTHERM STEAM GENERATORS

spot news

(Continued from page 98)

former areas, and will be assembled, wound, and tested in the new building.

An outstanding feature of the new building is its assembly pits for turbine generators. Actually large jigs, they will be used for the complete assembly operation. The finished generators will then be lifted into test pits, thus freeing the test pits for their true function since no assembly work will take place there.

Test floor apparatus includes a three-phase reactor to be used in running full-load tests on large generators. This new equipment will make it possible to load test more generating equipment and larger units than have ever before been so tested in this country.

A portable enclosure to be used for balancing and seasoning large rotors will permit all operations to be conducted within a totally enclosed, sound-absorbing structure. The enclosure can be used in any of the three test pits. A water recirculating system will provide the large quantities of water required for operations of the test floor. The system, which can handle 6000 gpm, utilizes city water for makeup only.

Workmen Borrow Idea From Deep-Sea Divers

Workmen cleaning underground fuel storage tanks at Tinker Air Force Base, were able to work more safely and efficiently by virtue of an idea borrowed from deep-sea divers. Two-way telephone communication was incorporated in the face-piece of the hose mask which the worker wears while underground. This enabled the man in the tank to report if he needed more air, if the hose leading to the surface became fouled, or if an unusual hazard was encountered. Efficiency also was increased because the men were

(Continued on page 122)

$6.40

Repair Cost for Valves in Sludge Burner Pump

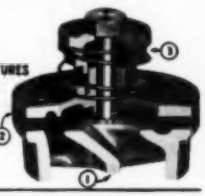
Valve parts were being replaced monthly in a large Eastern refinery. When Sims Pump Valves were installed — *guaranteed* to give longer service — *no* maintenance was necessary for over a year. Service then indicated a change in spring materials — cost: $6.40 — and an even further reduction of repairs was gained.

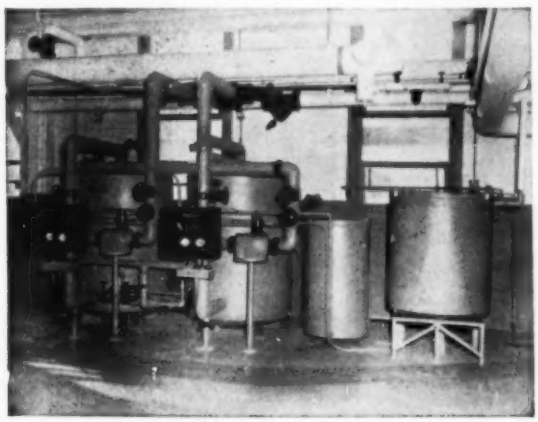
Sims Pump Valves are carried in stock for more than 40 different makes — and hundreds of sizes — of reciprocating pumps. Free catalog shows how they fit your pump, reduce maintenance, and give guaranteed better performance.

SIMS
PUMP VALVE CO. INC
1210 PARK AVE. HOBOKEN, N.J.
M & M BLDG. HOUSTON, TEXAS

...Only **SIMS** HAS THESE PATENTED FEATURES

1. Inclined ribs, which help increase pump capacity 20%.
2. Valve disc that rotates every time it lifts.
3. Double shock absorber stem head.





FULLY AUTOMATIC INVERSAND WATER SOFTENING PLANT

The above is one of our many hundreds of Water Conditioning Plants automatically operated by our H & T poppet type multiport valves.

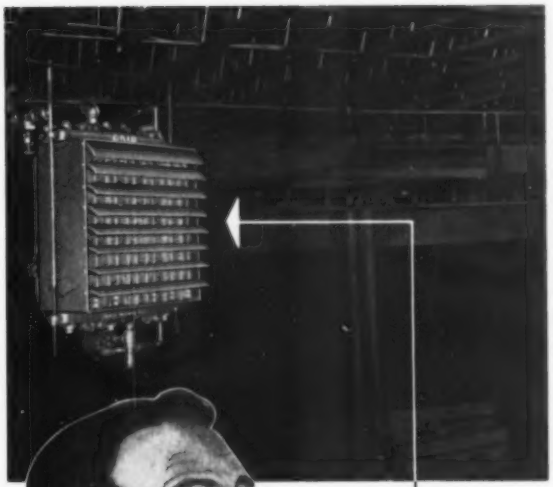
Whether your water problem is softening, filtration, alkalinity reduction, oil removal, or demineralization, requiring new units or modernizing old, we invite your inquiries.

Single or Multiple Units — Manual, Semi-Automatic or Fully Automatic — We can serve you.

OVER 50 YEARS EXPERIENCE

Write for FREE Bulletin

HUNGERFORD & TERRY, INC.
CLAYTON 1, NEW JERSEY



Put up to Stay up!

trouble free service for over 22 years...that's only one record for...

GRID UNIT HEATERS

That's the experience of a large midwest manufacturer. Twenty-two years of service without need for repairs prove to him that, with a GRID installation, first cost is last cost. Such service records (GRID installations made in 1929 are still operating) are the rule rather than the exception with GRID Unit Heaters because GRID was deliberately designed to be a better unit heater. To provide not only ample, comfortable heat, but to give years of service without the usual high maintenance cost generally experienced with ordinary unit heaters.

Such service records occur because GRID is completely different from other unit heaters — here's how:

GRID is an all cast unit with finned heating sections and headers tested to withstand steam pressures up to 250# P.S.I.

GRID construction uses no brazed, soldered, rolled or welded connections between condenser and headers. A specially designed threaded nipple assures a precision, leak-proof fit.

GRID construction has all similar metals in contact with steam, thus preventing electrolytic corrosion which eventually occurs in copper type unit heaters where steam passes from iron pipes into copper cores. (Write for booklet CORROSION IN UNIT HEATERS.)

GRID construction resists corrosion from fumes present in most types of industry.

GRID design incorporating low outlet temperatures, proper fan sizes and motor speeds, assures delivery of warm comfortable air in ample volume to the working level. No stratification of warm air at the ceiling to waste your fuel dollars.

These are the reasons why users of GRID Unit Heaters get 22 years and more of trouble-free service. There are units cheaper than GRID, but there is none better. You start saving money the day you install GRID Unit Heaters.

GET THE COMPLETE GRID STORY — WRITE FOR CATALOG CUH-846-A.

GRID Blast Coils are ideal for process drying — write for Catalog BC-1049.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

D. J. MURRAY MANUFACTURING CO.
MANUFACTURERS SINCE 1883 WAUSAU• WIS.

new bulletins

. . . catalogs from leading manufacturers

AIR FILTERS & DUST COLLECTORS

200—Fly Ash Collector

Operating principles of a regenerative fly ash collector for removing fly ash, soot, and cinders from boiler flue gas by centrifugal separation, are discussed in a 6-page folder. Such points as low draft loss and high efficiency are stressed. Installation is described, and a graph indicates performance. Breslove Separator Co.

BOILERS & BOILER ACCESSORIES

201—Oil & Gas Burner

Described in 16-page bulletin ID53-162 is a factory-coordinated, industrial fuel burning system. Built around an industrial burner for oil or gas firing, the system includes proper controls mounted in panels and wired to terminal strips for easy connection, factory engineered windbox and refractory ring, fuel oil heaters, and trim. How the system works is fully described, and ease of installation is stressed. Construction features are shown, and specifications are listed. York-Shipley, Inc.

202—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," a 24-page booklet, presents numerous actual case histories from industries of all sizes and types. Engineering survey results and such equipment as boilers, stokers, coal and ash handling units, and automatic controls, are presented for each installation. Annual fuel consumption and operating costs also are tabulated. Bituminous Coal Institute.

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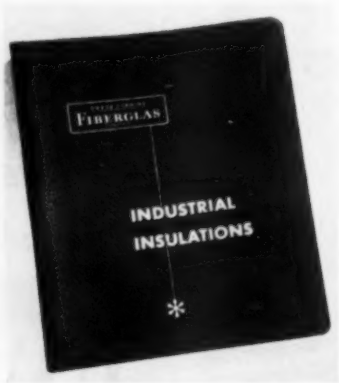
203—Boiler Baffles

"More Steam from Your Boilers," a 4-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

204—Package Boilers

Package boilers for gas, oil, or combination oil and gas firing, are appraised in 10-page bulletin A-104. A large cutaway view shows design and construction features of the Scotch-type boilers. Units from 20 to 100 hp are listed. Dimensions and specifications are tabulated. Eclipse Fuel Engineering Co.



THERMAL INSULATION

205—Industrial Insulations

Fibrous glass insulation products, and hydrous calcium silicate heat insulations, are the subject of an 84-page book. Fibrous glass insulations include pipe, equipment, duct, and low temperature types, and heat insulations contain products for use at temperatures from below zero to 1200 F. Descriptions of the products include properties, uses, forms and sizes, coverings and accessories, engineering data, application specifications, and ordering information. Owens-Corning Fiberglas Corp.

BUILDING MATERIALS & MAINTENANCE

206—Interior Finishes

Color-chips illustrating a group of colors especially prepared to insure color harmony for plant interiors and machinery, are presented in 6-page folder 125. Suggested applications for each type of finish also are presented. Rust-Oleum Corp.

207—Vacuum Cleaning Systems

Stationary vacuum cleaning systems are described in 8-page bulletin 121 B. In addition to applications such as cleaning of ceilings and walls, the booklet describes the cleaning of such industrial equipment as boiler tubes and filter screens. Various accessories are illustrated. The Spencer Turbine Co.

FANS & BLOWERS

208—Centrifugal Blowers

Design and performance features of multistage centrifugal blowers and exhausters for pressures from 1 to 9 psi, and vacuum from 2 to 12 in. of mercury, are appraised in 2-page data sheet A-932. Industrial applications are listed, including several in which savings can be made by replacing compressed air formerly considered necessary. Also included are typical performance and check lists of data required for optimum blower or exhauster specification. Air Appliance Div., U. S. Hoffman Machinery Corp.

HEAT EXCHANGER EQUIPMENT

209—Heat Exchangers

Hot water storage heaters and heat exchangers are the subject of 16-page catalog 5. Included among the various types of equipment are horizontal and vertical hot water storage heaters, instantaneous water heaters, converters, condensate coolers, fuel oil heaters, and instantaneous suction heaters for viscous fluids In addition to discussing applications and construction, the literature presents tables to aid the engineer in selecting proper equipment. Typical examples are included to demonstrate use of the tables. Patterson-Kelley Co., Inc.

ELECTRICAL EQUIPMENT

210—Flexible Conduit

Flexible, liquid-tight electrical wiring conduit, presented in 4-page folder UA-530, is described as the first of its kind to gain UL approval for use in wet locations. A cutaway view shows construction. Suggested applications and specifications are included. American Metal Hose Branch, The American Brass Co.

211—Motor Standards

New frame dimensions for a-c motors from 1 to 30 hp, as established by new motor standards passed by NEMA on May 19, are presented in 8-page bulletin GEA-5995. The publication compares the old with the new frame assignments for open-type polyphase, single-phase, and wound-rotor motor as well as totally-enclosed, fan-cooled types. Also listed are suggested new frame assignments for foot-mounted and flange-mounted motors, and standards for

NOTE — Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Insert key numbers on return post card found on page 111.

minimum locked-rotor torque for general purpose single-phase motors. General Electric Co.

212—Control Equipment

What to look for in maintaining control equipment is told in 8-page manual 14X-7612A, entitled "Proper Maintenance of Control." Besides giving helpful suggestions toward overcoming some of the most frequent difficulties common to most electrical control devices, the booklet presents a handy, trouble-shooting chart, showing the symptom, cause, and cure. A check list is included to aid in establishing a proper maintenance schedule. Allis-Chalmers Manufacturing Co.

213—Demand Meters

Theory and economics of demand metering, as well as the operation and application of demand meters, is discussed in 48-page manual GET-2327. The booklet, which provides an excellent summary of the principles and problems of demand metering, should serve as a helpful reference for specific application problems. Rather than emphasize the details of meter construction, installation, or maintenance, the manual serves as a centralized source of basic information. General Electric Co.

214—Motor Starters

Magnetic switches for across-the-line starting of single-phase and polyphase squirrel cage motors in sizes up to 400 hp, 600 v a-c, are the subject of 12-page bulletin 504. Application, construction, safety features, modifications, and accessories are discussed. Tables list dimensions and weights for various types. Federal Electric Products Co.

215—Protective Relays

Principles of modern practice are explained in a new and expanded edition of "The Art of Protective Relaying," 72-page booklet GET-1768A. The literature contains information on types of relays used for protecting such apparatus as generators, transformers, and transmission lines. It outlines procedure for evaluating power apparatus and system characteristics to determine proper applications and settings of relays. It also gives a complete listing of available equipment with references to detailed literature. General Electric Co.

216—Distribution Transformers

Brief descriptions of distribution transformers from 25 to 1000 kva, with various primary and secondary voltages, are presented in 4-page folder 50-FC. Units are air-cooled. In addition, standard lighting transformers are listed. Marcus Transformer Co., Inc.

217—Plug-In Panelboards

Features of plug-in distribution panelboards, for 250 and 575 v operation, are appraised in an 8-page bulletin. Engineering data and application information, together with specifications, are presented. Federal Electric Products Co.

218—Rectifiers

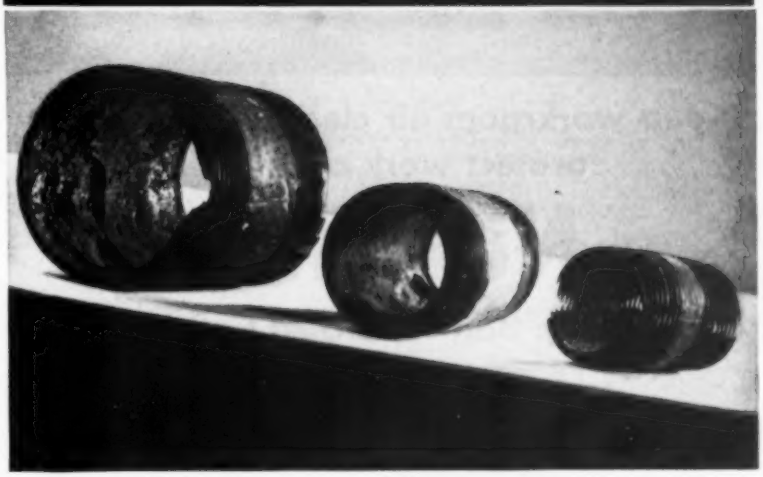
Application of rectifiers to various operations is explained in a brochure. A question-and-answer section explains the benefits of keeping d-c equipment working on a-c while retaining d-c speed control. In addition, construction features and advantages are summarized. American Rectifier Corp.

219—Wire & Cables

"Wires & Cables for the Chemical and Petroleum Industries," a 76-page booklet, has been published to serve as a reference

(Continued on page 104)

STOP CORROSION
with BIRD-ARCHER AMINE TREATMENT



Unretouched photograph shows the ravages of corrosion on condensate return lines.

Corrosion of piping in steam and condensate return lines is an expensive two-way headache. (1) It leads to large outlays for pipe replacement and maintenance. (2) It often results in plugged return lines and traps due to the solid products of corrosion. Bird-Archer Amine Treatment effectively eliminates these troubles at low cost.

Here's how. Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself. In scores of plants, this Bird-Archer system has more than paid for itself by substantially cutting replacement and maintenance costs.

BA-902

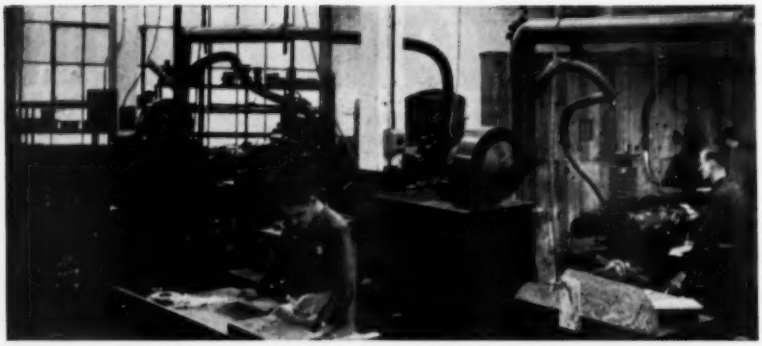
Bulletin CP 100 gives all the facts on Bird-Archer Amine Treatment. Write for your copy.

LABORATORIES ENGINEERS · CHEMISTS

BIRD-ARCHER WATER TREATMENT

THE BIRD-ARCHER COMPANY, 4337 NORTH AMERICAN ST., PHILADELPHIA 40, PA.
NEW YORK • CHICAGO

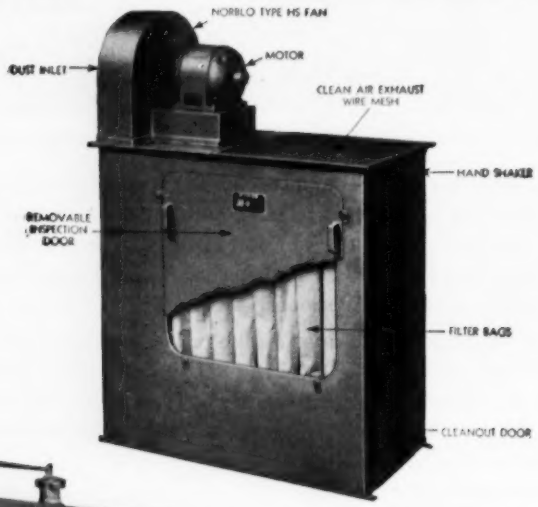
IN CANADA: The Bird-Archer Co., Limited, Cobourg, Ontario
IN MEXICO: Calderas y Accesorios, S. A., Amsterdam 291, Mexico, D. F.



Keep workroom air clean—
protect work and workers with

Norblo

Portable bag-type Dust Collectors



Many plants can be effectively and profitably equipped with Norblo Portable and Semi-Portable Dust Collection Units, to remove unhealthful and sometimes dangerous contaminants from dust-producing machines. Localized dust control for grinding, polishing, sawing and other operations is thus provided at much lower cost than with a large centralized system.

Norblo Portables occupy small space, can be elevated to save floor area. And they're easily moved if re-location of machines proves desirable. Units are available in various arrangements for dust clean-out. Six sizes range from 300 to 1350 C.F.M., operate at 8" static pressure at the fan. Also larger sizes—semi-portable. Write for Bulletin 163-5.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

6423 Barberton Ave. OLympic 1-1300 Cleveland 2, Ohio

new bulletins

(Continued from page 103)

book on this subject. It is divided into four main sections: insulation compounds; jacket compounds; constructions; and technical data. The compound sections have been expanded to include butyl insulation, heat and moisture-resistant insulations, thermoplastic types, general-purpose neoprene jacket, and polyvinyl chloride type jacket. Electric Wire and Cable Dept., United States Rubber Co.

220—Wound-Rotor Motors

Described in bulletin 1300 are wound-rotor motors from ½ to 1000 hp. The bulletin covers principles of operation and contains performance curves and characteristics to indicate how units are suited to particular applications. It also outlines construction, methods of manufacture, and the various available enclosures. Louis Allis Co.

221—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages, the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

PUMPS & COMPRESSORS

222—Controlled Volume Pumps

Design features and construction of motor-driven controlled volume pumps are described in 40-page booklet 553. Technical data include capacity-pressure selection tables, types of capacity adjustments, standard and special designs, and packaged systems. A 2-page chart describes typical applications in six major industries. Also included is a 4-page materials selection chart. Milton Roy Co.

223—Ceramic Pump Plungers

Ceramic plungers for reciprocating pumps are the subject of 4-page folder W-404-B5. Listed among the advantages are resistance to corrosion and abrasion, and consistant, high-strength properties. Chemical and physical properties are tabulated, and the manufacturing process is described. Installation hints are presented. The bulletin states that the product is interchangeable with metallic plungers on units now in service, as well as being available on new units. Reciprocating Pump Div., Worthington Corp.

224—Magnetically Driven Pump

Construction features and design theory of a recently developed magnetically-driven, combined motor and centrifugal pump are described in 4-page folder G-1000. According to the bulletin, the unit has no seals or stuffing boxes, it is totally enclosed to prevent fluid losses, and does not

require lubrication. Typical performance curves and a tabulation of dimensions are included. Chempump Corp.

225—Vertical Turbine Pump

Inherent characteristics of vertical turbine pumps are briefly described in 12-page bulletin W-450-B41. To point out the diversified applications for this unit, the booklet presents actual case histories of its use in deep wells, to move water from surface sources, for recirculating cooling water, and for condensate return, booster service, and fire prevention. Worthington Corp.

226—Screw Pumps

Screw pumps for non-lubricating fluids and semi-fluids are featured in 6-page folder SE-5. A large cutaway view shows construction features. Applications, advantages, and specifications are listed. Sier-Bath Gear and Pump Co., Inc.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.

HEATING, AIR CONDITIONING, & REFRIGERATION

227—Gas-Fired Unit Heater

Suspended space heaters for use with any type of gas fuel are the subject of 6-page folder 543. Complete specification data, with dimensions and capacities of both propeller fan and blower type units, are presented. Output capacities are listed from 70,000 to 178,000 Btu per hr. How they can be used for heating, ventilating, and process drying, either with or without ductwork, is explained. Heating Dept., Dravo Corp.

INSTRUMENTS & CONTROLS

228—Control Systems

Discussed in 6-page folder 3010 are control systems for the power industry. To suggest how control systems can be arranged, the bulletin presents views of actual installations and discusses some of the interesting details. Panellit, Inc.

229—Temperature Regulators

Self-operating temperature regulators for steam, liquids, and gases are appraised in 8-page bulletin ST162. Design features and specifications are presented for direct acting and reverse acting types. Engineering data are included in a section describing how to select regulators. Also described are accessories including separable bulb sockets, bulb packing glands, and cast iron strainers. Farris Stacon Corp.

230—Orifice Meters

Construction features and operation of orifice meters are described in 28-page booklet 1050 Rev 1. Tables giving representative orifice capacities offer time-saving help in sizing orifice meter plates. How meters are used with liquid seal chambers and piping for steam, corrosive gases, and liquids, is discussed. Also included are general instructions for meter servicing, descriptions of meter testing and operating practice, square root charts, and instructions for testing differential. Rockwell Manufacturing Co.

(Continued on page 106)

This NEW METHOD DRIES AIR

PRECISELY as you want it

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

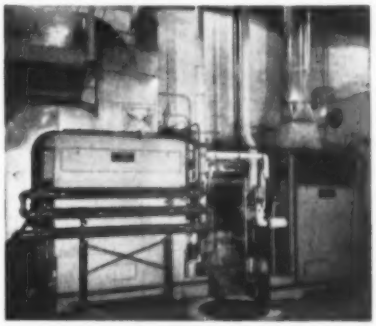
Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



Niagara Controlled Humidity Air Conditioning

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

For complete information write

NIAGARA BLOWER COMPANY

Dept. IP, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

The MODERN Steam Trap

Moving parts, particularly in steam traps, are subject to to corrosion, pitting, sticking and breaking.

When this occurs the trap no longer functions. Time sometimes elapses before the failure is detected. The trap must then be dismantled and repaired. Production is interrupted. Costs go up.

Drainator — the modern steam trap — avoids these difficulties by eliminating the parts which cause them. It has not a single moving part but is operated by properties in the steam. A fluctuating gauge glass signals that the trap is functioning properly.

Modernize your steam using equipment by installing the modern steam trap. Write for the complete and interesting story now.

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502 BANK STREET • PAINESVILLE, OHIO

Gentlemen:

Please send us literature describing items checked

☐ COE Drainator Steam Traps
☐ COE Safety Water Heater

Name_____

Address_____ City_____

Company_____

new bulletins

(Continued from page 105)

231—Mold Temperature Control

Discussed in 8-page technical bulletin 7 is the problem of maintaining proper temperature control of injection molding equipment. Ten pertinent questions regarding the importance of injection mold temperature control are answered by experts in the field. Also included is a chart which lists the mold difficulties which occur with various thermoplastics when the temperature is too high or too low. Features of a heating and cooling unit are discussed. Sarco Co., Inc.

232—Industrial Controls

Non-indicating electric, electronic, and pneumatic controllers for temperature, pressure, and humidity, are appraised in 84-page catalog 8305. Equipment such as pneumatic and electric valves, switches, and relays, also are discussed. General discussions are presented on applications for industrial controls and automatic control systems. The booklet also contains engineering information such as specifications and application data. Industrial Div., Minneapolis-Honeywell Regulator Co.

LUBRICANTS & LUBRICATION EQUIPMENT

233—Lubricating Oil

Excellent time-temperature characteristics and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.

VALVES & REGULATORS

234—Valves

Needle, globe, plug, check, relief, and special valves are described in 44-page catalog 352A. Units listed are made of various metals, and are suitable for instrumentation, processing industries, hydraulic systems, and industrial applications. Details of construction are shown, and complete specifications and dimensions are given. Republic Manufacturing Co.

235—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications, and drawings indicate design features. Davis Regulator Co.

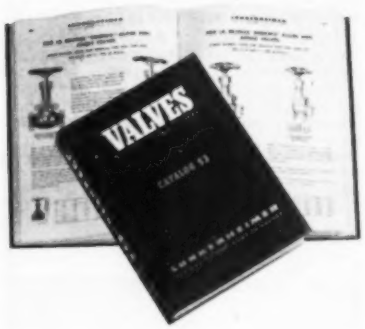
236—Regulating Equipment

Specifications and operational data for steam, gas, air, oil, and water regulating

equipment are presented in 64-page catalog 53. Descriptions are given for pressure, temperature, and combination pressure and temperature regulators; diaphragm valves; motor operator valves; float valves; pop valves; strainers; solenoid and motor valves; and water gages. In addition to capacity tables, engineering data includes flange charts, a table of steam pressures and corresponding temperatures, and a table of water heads and equivalent pressures. O. C. Keckly Co.

237—Safety Shut-Off Valve

How a temperature actuated, automatic, safety shut-off valve can be used to check fuel-fed fires is explained in a 4-page folder. The valve can be used on any type of line, either liquid or gas, at any pressure. In addition to giving advantages, construction features, and specifications, the bulletin illustrates typical installations. Valco, Inc.



238—Valves

Steel, iron, and bronze valves, as well as lubricating devices, boiler mountings, cocks, and other products, are described in a 506-page catalog. Over 100 pages of reference data are provided. A handy, illustrated, thumb-indexed selector guide groups valves according to pressure classifications to enable the engineer to find specifications, reference data, and code requirements for any valve in a matter of seconds. The Lunkenheimer Co.

239—Solenoid Valves

Engineers concerned with the use of solenoid valves should find considerable information of value in 80-page catalog 24. A quick-reference index increases the usefulness of this booklet. Charts are presented to aid in selecting the correct unit for any application. Nomographs give flow of water, air and gas, and steam for standard full area valves. Descriptions and specifications for many types of packless and packed units are presented. Automatic Switch Co.

MATERIALS HANDLING EQUIPMENT

240—Conveyor Belting

Installation and maintenance of conveyor and elevator belting is the subject of a 36-page engineering manual. An explanation of how to select belts includes considerable engineering data. Among the many topics covered are: systems for handling wet, corrosive, sticky or freezing material; how to make conveyor belts run straight; causes and effects of excessive tension; selection and installation of pulley lagging; ways to avoid belt wear at loading point; use of damage-preventing appliances; and the effects of defective idlers. The B. F. Goodrich Co.

(Continued on page 108)

More and More Better Plants specify HOFFMAN for

Multistage Centrifugal BLOWERS and EXHAUSTERS

on applications like these

- AGITATION OF PLATING SOLUTIONS
- CONTINUOUS DRYING OPERATIONS
- ORE FLOTATION
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- PNEUMATIC CONVEYING
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- RAW WATER ICE PLANTS
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- GAS BLOWERS AND BOOSTERS
- YARN DRYING
- WRAPPING, PACKING AND STACKING MACHINES
- EJECTION OF STAMPINGS FROM CONTINUOUS PUNCH MACHINES

IT'S A FACT! Hoffman Blowers often can effect a valuable saving on applications where high-cost compressed air was formerly considered necessary.

VACUUM CLEANING

to give "One Stroke" 100% Effective Dust Removal

Reduce plant maintenance and production costs throughout your plant. Four sizes of portable units, all built for heavy-duty industrial service. Stationary systems, with central collection and multi-sweeper capacity. A complete selection to provide the right size and type for most economical solution of your dust problem and to supplement present dust collection with 100% effective control.

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9-9 FOURTH AVENUE, NEW YORK 3, N. Y.

CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

new bulletins

(Continued from page 107)

241—Car Spotters & Pullers

Vertical capstan and horizontal drum type car spotters and pullers are appraised in 24-page booklet 2092. Features and specifications for many types are presented. Engineering information for calculating rope pull for railroad cars, and for planning layouts, is included. Although designed specifically for moving railroad cars, the brochure suggests many other industrial applications requiring horizontal haulage. Link-Belt Co.

242—Storage Systems

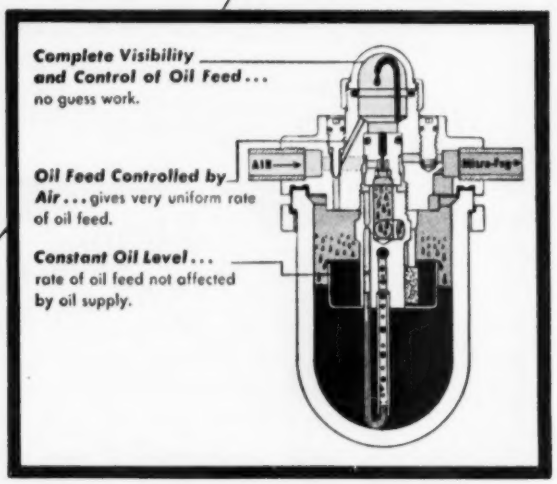
"Modern Industrial Storage Systems," 12-page brochure 4393, discusses the subject of storage for raw ingredients, semi-processed, or finished material. The flexibility and adaptability of concrete silos is discussed. Descriptions of component parts and construction are supplemented with line drawings. The Marietta Concrete Corp.

243—Tanks

Bulletin 53DL describes how the membrane incorporated in Dialift tanks eliminates breathing losses and reduces filling losses. Advantages of this type of construction are described, and available sizes are listed. Also described is how a tank can be used as a single unit, tied in with a battery of tanks, or converted from a cone roof tank installation. Hammond Iron Works

NOW

another new development in *Micro-Fog* lubrication by NORGREN


Complete Visibility and Control of Oil Feed... no guess work.
Oil Feed Controlled by Air... gives very uniform rate of oil feed.
Constant Oil Level... rate of oil feed not affected by oil supply.
AIR
Micro-Fog

for Bearings... Gear Chambers... Small Air Devices

This new Norgren Micro-Fog Lubricator is designed particularly for use where maximum oil fog is required with minimum air consumption.

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2434 So. Elati St., Englewood
IN COLORFUL COLORADO
Valves • Filters • Regulators • Lubricators • Hose Assemblies

WRITE, NOW, FOR COMPLETE DATA

Pioneer and Leader in Oil Fog Lubrication for 25 Years

244—Gates & Valves

Various types of gates and valves for handling bulk materials are briefly described in 20-page catalog 1252. Advantages, applications, construction, and dimensions are presented. In addition to such conventional units as slide and quadrant gates, the booklet presents newly developed units including a double-closure bin valve and a new bin gate. Stephens-Adamson Mfg. Co.

WATER TREATMENT & WASTE DISPOSAL

245—Feedwater Demineralization

Mixed bed and two-step demineralization to meet specifications of high pressure boiler feedwater is discussed in 16-page reprint 3836. Economic aspects of demineralizing various water supplies are discussed. Cost comparisons are outlined, make-up water requirements are specified, and curves show economies of operation. The Permutit Co.

246—Water Conditioning

Water conditioning for boiler, process, and general applications is discussed in 20-page bulletin 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems for boiler, process, and general water conditioning purposes are covered. Data are presented on filters, purifiers, degasitors, zeolites, ion-exchange resins, and water treatments for all purposes. Elgin Softener Corp.

247—Gravity Filters

Gravity filters are the subject of 24-page booklet 2539A. Concrete, steel, and wood types are discussed. Useful engineering information, including tables of specifications and a nomograph for selecting wash trough dimensions are presented to aid the engineer in planning systems. Controls also are discussed. Operating characteristics, outline dimensions, and typical installations are included. The Permutit Co.

248—Zeolite Water Softeners

Water softening by ion exchange is the subject of 12-page bulletin WC-108. It explains the distinction between the sodium and hydrogen cycle, and shows differences in results obtained by the two processes. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. An appraisal of ion exchange materials includes a table of characteristics. A simple method of sizing zeolite softeners and a table of recommended flow rates aids in determining equipment to meet requirements. Graver Water Conditioning Co.

MATERIALS OF CONSTRUCTION

249—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two available bulletins. Each publication including books, bulletins, and technical papers, is de-

scribed briefly. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

250—Rubber Lined Construction

Advantages of rubber lining for steel tanks, drums, pipes, valves, fittings, and pumps for storing and handling acids and corrosive chemicals are appraised in an 8-page bulletin. Tables give resistance of rubber lining to inorganic acids, salts and alkalies, organic materials, and miscellaneous materials. Details on abrasive and temperature resistant qualities also are discussed, and the various types of linings are described. Protective Coatings Div., Metalweld, Inc.

MECHANICAL POWER TRANSMISSION

251—Power Transmission Equipment

Described briefly in 60-page catalog 53-110, are power transmission and conveying products such as cast and steel chains, elevator buckets, take-ups, cast sprockets, belt idlers, and spray nozzels. Construction and advantages are discussed. Engineering data is provided to aid in selection. Chain Belt Co.

TO REQUEST FREE BULLETINS

Insert "key" numbers on return post card found on page 111. Your requests will be handled promptly.

***—Industrial Belting**

Considerable engineering data are contained in a 48-page technical manual on transmission, conveyor, and elevator beltings. General information is handled in a question-and-answer style. Engineering phases of belting are recorded in tables and charts, while diagrams are used to clarify intricate and obtuse problems. ***Please send requests on company letterhead directly to Boston Woven Hose & Rubber Co., Dept. IP, P. O. Box 1071, Boston 3, Mass.**

252—Fluid Drives

Operating principles for variable speed fluid drives are discussed in 24-page bulletin 9319. Component parts, applications, advantages, dimensions, auxiliaries, and controls are discussed. Included in an engineering section are torque charts and a table on speed reduction factors. Hydraulic Coupling Div., American Blower Corp.

PIPE, TUBING, & HOSE

253—Rubber Hose

"Tips on Hose Care," a 4-page folder, describes the proper procedure in the use and storage of various kinds of hose, including steam, fire, oil, gasoline, water, air, suction, and sandblast types. A list of do's and don'ts are included to simplify installation. Methods of making static bond also are described. Hewitt Rubber Div., Hewitt-Robins, Inc.

254—Pipe & Pipe Fabrication

Specifications for all sizes of pipe from ⅛ to 24 in. in diameter are presented in 16-page catalog 575C. Tables give data and descriptions of standard, extra strong, and double extra heavy pipe, spiralweld pipe, large OD pipe, line pipe, electric-weld tubing, welding fittings and flanges, oil well casings, and water well casing. Facilities for fabricating pipe for structural uses also are discussed. L. B. Foster Co.

255—Flexible Metal Hose

Flexible metal hose developed to isolate vibration in connecting suction and discharge lines to refrigeration and air conditioning machinery, pumps, and turbines, is described in a data sheet. Specifications are listed in tables, and a section of installation instructions classifies the various types of motions. Chicago Metal Hose Div., Flexonics Corp.

256—Prefabricated Conduit System

Introduced in 4-page folder 5210, is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The literature explains how the system is installed and stresses the simplicity of making joint connections. The Ric-wiL Co.

MISCELLANEOUS

257—Blast Cleaning Machines

Two fundamental methods of applying abrasives with hand-operated, nozzle, blast cleaning machines are appraised in 28-page booklet 100A. In addition, applications for both wet and soft abrasives are discussed. Design features, construction, and operation of various types of blast cleaning hose machines are described. Tables indicate the relationship between orifice area, circumference, nozzle sizes, air flow, and required horsepower. Pangborn Corp.

—End

Take a good look at this critical PACKING INSTALLATION...

Style 805-MBF Used On This 10-Stage High Pressure Boiler Feed Pump

This set of packings is going to handle a tough job. The pump is rated at 965 gpm, 4250′ total head, handling *hot* (312°F.) boiler feed water at 89# suction pressure and driven by a 3850 rpm induction motor (shaft sleeves are chrome plated—675 Brinell).

There are many styles of "John Crane" Packings—but Style 805-MBF was recommended and used because it was developed *and developed alone* for high speed centrifugal boiler feed pumps. The natural lubricating characteristics in the design of the monel and asbestos yarn braid-over-braid construction makes it a strong, wear resistant packing. Used in hundreds of installations all over the world—it has proved to be a highly efficient, long-life, trouble-free packing that gives you the results you want.

For quick action, let our Engineering Department help you. Write for latest "John Crane" Packings Catalog. Crane Packing Company, 1831 Cuyler Avenue, Chicago 13, Illinois.

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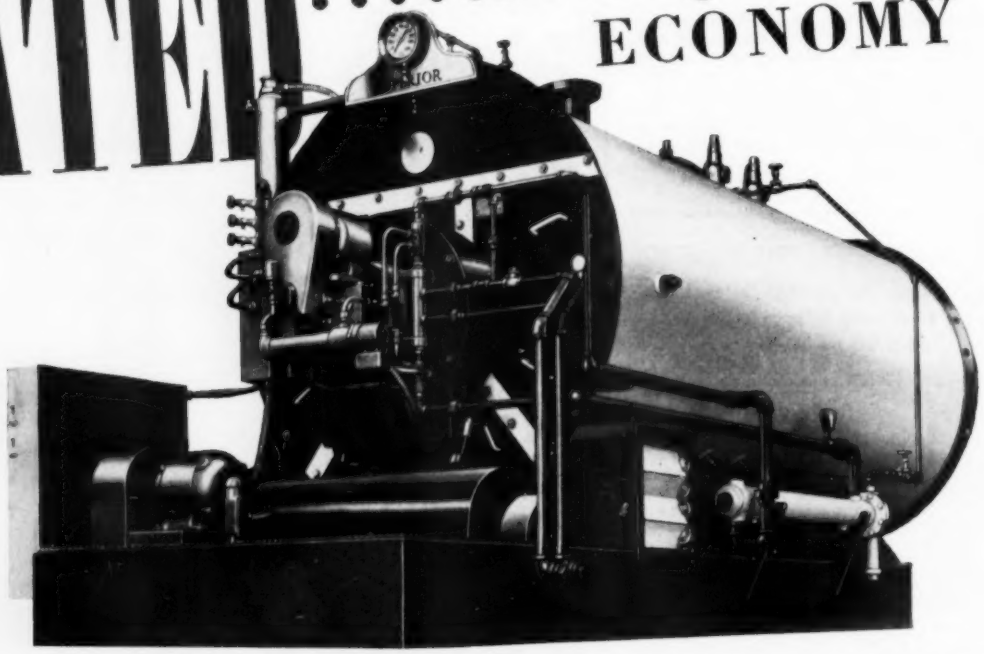

SUPERIOR STEAM GENERATORS

. . . are built to maintain full capacity operation at highest efficiencies throughout a longer serviceable life. Their full 5 sq. ft. of heating surface per b.h.p. provides maximum heat transfer at normal firing rates, assuring longer life, and eliminating the excessive maintenance and high electrical costs, caused by overfiring boilers with inadequate heat transfer surface.

Superior Steam Generators are rated for actual working performance under ordinary boiler room conditions . . . not on the basis of laboratory tests under ideal conditions.

A steam generator is a long-term investment. In the course of its life, operating savings can far outweigh initial cost. Specify Superior Steam Generators and profit from their operating savings for years to come.

Superior Steam Generators are fully automatic, burn oil or gas or both . . . 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water. For complete details, write for catalog 502.

for performance you can **BANK** on

SUPERIOR COMBUSTION INDUSTRIES INC.
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SUPERIOR STEAM GENERATORS

3 special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in

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No's	No's	No's

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Your Name _____ Title _____

Your Company _____

Co. Address (St. & No.) _____

City _____ State _____

Inquiries for items in this issue not serviced beyond November 1, 1953

readers' guide

. . . to advertised products

AIR FILTERS & DUST COLLECTORS

Key No. 500—Bull 163-5 describes Norblo portable dust collectors. The Northern Blower Co. p 104.

Adv. p 21 contains information on dust and fume control by The Kirk & Blum Mfg. Co.

Cottrell electrical precipitators are described on p 48. Research Corp.

Key No. 501—Advantages of CMP (combination Multiclone-Cottrell precipitator) unit outlined in bulletin. Western Precipitation Corp. p 34.

BOILERS & BOILER ACCESSORIES

Key No. 502—Bulletin contains data on Powermaster packaged boilers with Voriflow. Orr & Sembower, Inc. p 29.

Adv. p 40 contains information on Diamond soot blowing system. Diamond Power Specialty Corp.

FW package steam generators are described on p 54. Foster Wheeler Corp.

See adv. p 95 for information on coal by Bituminous Coal Institute.

Adv. p 47 contains data on John Zink Series YC combination gas and oil burner. John Zink Co.

Key No. 503—Bull WG-1811 describes Yarway flat glass gages with Type "M" illuminator. Yarnall-Waring Co. p 62.

Key No. 504—Coupon p 124 offers further information on Amesteam generators. Ames Iron Works Inc.

Further details available on how Enco oilburners can be adapted to your present pulverized coal burners. The Engineer Co. p 121

Adv. p 45 contains data on Erie City fire tube and water tube waste heat type boilers. Erie City Iron Works.

Key No. 505—Complete details on Superior water-tube steam generators are described in Cat 502-W. Superior Combustion Industries, Inc. p 59.

Key No. 506—Bulletin available on Detroit RotoGrate stokers. Detroit Stoker Co. p 22, 23.

Key No. 507—Complete details on Superior steam generators are described in Cat 502 Superior Combustion Industries, Inc. p 110.

Key No. 508—Complete data on Southern's engineered, industrial coals. Also free booklet on the storing of coal. Southern Coal Co. p 57.

Descriptive literature available on Wickes steam generators. The Wickes Boiler Co. p 49.

Key No. 509—Cat AD-100 contains complete data on standard size oil, gas, combination oil/gas fired boilers. Cleaver-Brooks Co. p 35.

Key No. 510—Available folder "All Your Questions Are Answered by Cyclotherm." Cyclotherm Div., U. S. Radiator Corp. p 100.

Key No. 511—Ready reference chart shown on p 18, 19 is available upon request. Eastern Gas & Fuel Assoc.

BUILDING MATERIALS & MAINTENANCE

Key No. 512—Free sample and data sheet on Fel-Pro C-5 "Hi-Temp" thread compound. Felt Products Mfg. Co. p 125.

Key No. 513—Free Repair Handbook describes Smooth-On repairs. Smooth-On Mfg. Co. p 125.

(Continued on page 114)

PRODUCT INDEX

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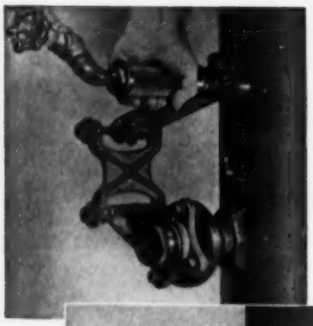
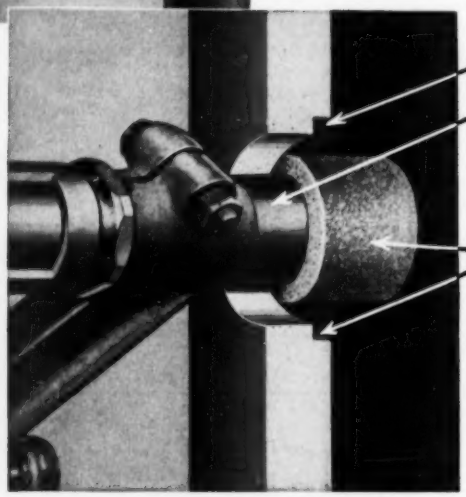
NOTE—This department is both a product index for advertising and a keyed listing for advertised literature. Refer to advertisement on page indicated and contact advertiser directly —or list paragraph key numbers on reader service card (page 111) to get data you want

Quick, easy and accurate job on refacing handhole seats with the



ELLIOTT HANDHOLE SEAT GRINDER


WIDTH OF SEAT
controlled by
GUIDE ROLLER
available in all sizes for seat widths from 3/16 in. to 21/32 in.
GRINDING WHEEL
acts as a surface grinder and is rigidly precision-controlled to move in a single plane which is the face of the seat, assuring positive flatness and a sure-tight seat.

Here is the modern time-saving and surely accurate way to reface handhole seats that have become corroded, scarred or wire-drawn. The grinding wheel of the Elliott handhole seat grinder is first inserted in the handhole to be refaced, then the base of the unit is clamped rigidly to the stud of an adjacent handhole, and leveled by adjusting the leveling screws. The plane of grinding, vertical to the axis of the hole, is fixed as to depth by the adjusting feed nut.

Setting up takes only a few minutes and the actual grinding only a few minutes more. Compare that to the labor and inevitable inaccuracy of hand filing or of a hand-held power grinder. Consider too, the certainty of *knowing* you have a tight seat, instead of the anxious testing and finding you haven't, when the pressure ultimately goes on.

Available with air drive, or electric motor as shown above. For details contact your local Elliott representative or write Elliott Company, Springfield, Ohio.

ELLIOTT Company

LAGONDA DIVISION

Y3-2

readers' guide

(Continued from page 113)

Key No. 514—Booklet with details on "Design Factors for Vacuum Cleaning and High Pressure Pneumatic Conveying Systems." U.S. Hoffman Machinery Corp. p 107.

ELECTRICAL EQUIPMENT

Key No. 515—Bull VA-180 gives complete specifications of Acme Electric variable voltage regulators. Acme Electric Corp. p 127.

Adv. p 31, 32 contains information on I-T-E unit substations for modern plant distribution. I-T-E Circuit Breaker Co.

Key No. 516—Available 20-minute film "The Vital Link" and Industrial Power Distribution Idea Book. General Electric Co. p 26, 27.

Key No. 517—Price list and catalog available on "Economy De-Lay" Renewable fuses. Economy Fuse & Mfg. Co. p 50.

Individually enclosed circuit breakers are described on p 10, 11. I-T-E Circuit Breaker Co.

Key No. 518—Coupon on p 14,15 offers complete facts on Fusetron dual-element fuses. Bussmann Mfg. Co.

ENGINES & TURBINES

Key No. 519—Bull SW-1a contains information on Wing steam turbines. L. J. Wing Mfg. Co. p 28.

Worthington steam turbine generators are described on p 41. Worthington Corp., Steam Turbine Div.

FANS & BLOWERS

Key No. 520—Coupon on p 37 will bring complete information on Coppus blowers and ventilators. Coppus Engineering Corp.

Chelsea fans for every industrial application are described on p 128. Chelsea Fan & Blower Co., Inc.

FILTERS, STRAINERS & PURIFIERS

Key No. 521—Bulletin contains data on Flo-Klean filters. Cuno Engineering Corp. p 42.

Key No. 522—Bull 5308 contains strainer dimensions, pressure drop charts and pressure-temperature limit tables. Leslie Co. p 39.

HEAT EXCHANGER EQUIPMENT

Key No. 523—Coupon on p 99 offers booklet on Pick instantaneous water heaters. Pick Mfg. Co.

Literature available on Airetool tube cleaners and expanders for heat exchanger and condenser tubes. Airetool Mfg. Co. p 118.

Key No. 524—Bull RC-1 contains data on horizontal and vertical types shell and tube condensers. Henry Vogt Machine Co. p 52.

HEATING, AIR CONDITIONING & REFRIGERATION

Key No. 525—Catalogs CUH-846-A & BC-1049 contain complete data on Grid unit heaters and blast coils. D. J. Murray Mfg. Co. p 101.

Adv. p 105 describes Niagara's controlled humidity method using Hygrol moisture-absorbent liquid. Niagara Blower Co.

INSTRUMENTS & CONTROLS

Key No. 526—Available questionnaire or Cat 600-14 on self-operated temperature regulators. Sarco Co., Inc. p 129.

Key No. 527—Bull CA-8R describes Mercoid relay for audible alarm. The Mercoid Corp. p 125.

Key No. 528—Catalog gives information on Auto-Lite temperature indicators and recorders. The Electric Auto-Lite Co. p 123.

Key No. 529—Details available on Liquidometer tank gage. The Liquidometer Corp. p 128.

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LUBRICANTS & LUBRICATION EQUIPMENT

Complete data available on Micro-Fog lubrication for bearings, gear chambers and small air devices. C. A. Norgren Co. p 108.

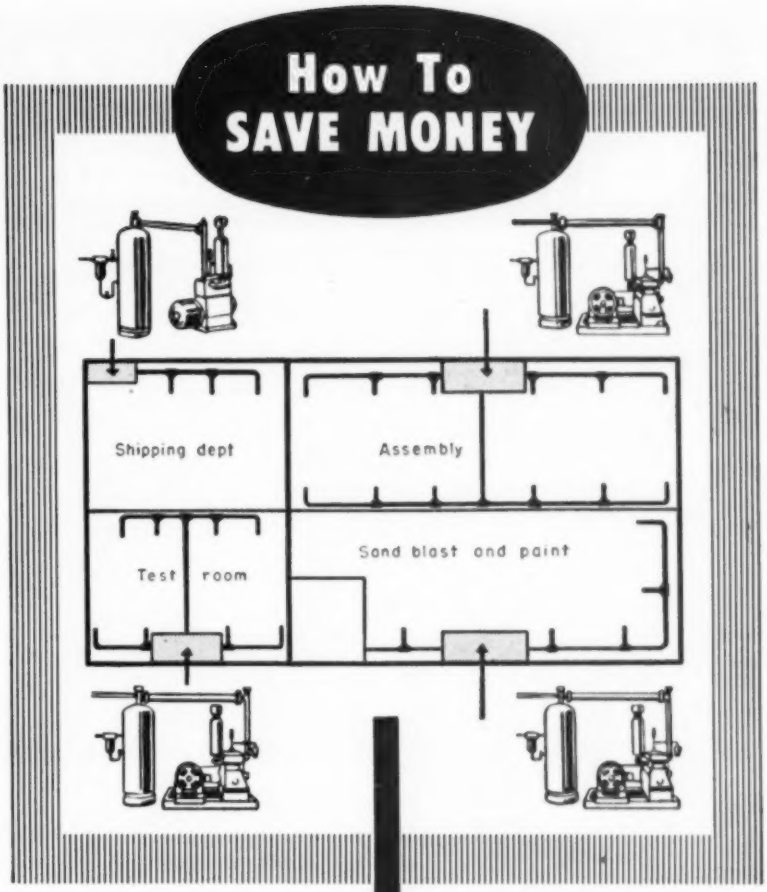
Key No. 530—Free publication "Genius at Work" describes Kroil for loosening frozen parts. Kano Laboratories. p 127.

Rubilene oil for diesel lubrication is described in adv. p 43. Sinclair Refining Co.

Texaco Regal Oils are described on p 130. The Texas Co.

Adv. p 55 contains information on Standard HD oil. Standard Oil Co. (Indiana).

(Continued on page 116)



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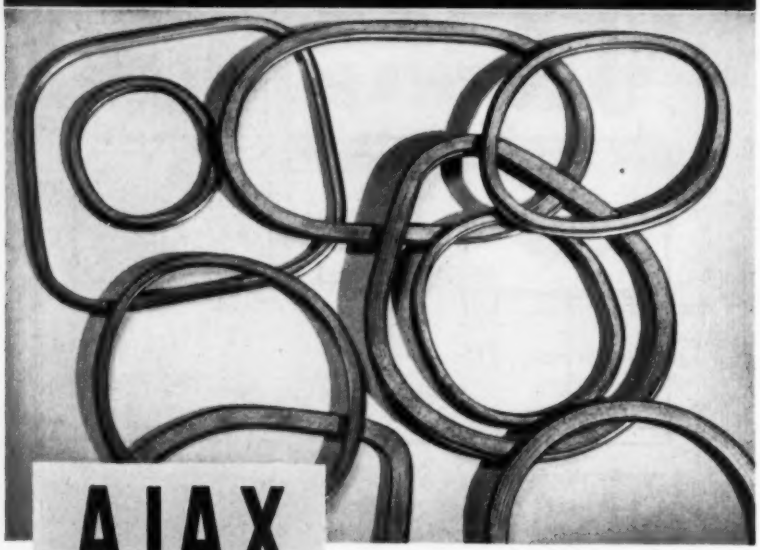

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readers' guide

(Continued from page 115)

MATERIALS HANDLING EQUIPMENT

Key No. 531—Book 2410 contains drawings and photographs of outstanding coal handling systems. Link-Belt Co. p 3.

MECHANICAL POWER TRANSMISSION

Key No. 532—Catalog and engineering data available on Lovejoy variable speed pulleys. Lovejoy Flexible Coupling Co. p 123.

Key No. 533—Basic Dynamatic units for adjustable speed drive problems are described in Bull GB-1. Dynamatic Corp. p 51.

PACKING & GASKETS

Key No. 534—6-page guide, "Johns-Manville Packings for the Power Plant" available. Johns-Manville Corp. p 60.

Key No. 535—Catalog contains complete information on John Crane packings. Crane Packing Co. p 109.

for your convenience

READERS' GUIDE

See page 113 for classified list of literature offered by advertisers.

You'll find it so convenient to use one of the postcards on page 111 for requesting literature or more information about advertised products. Just write in the key numbers corresponding to the material you want and drop the card in your OUT basket. Your request will be processed quickly and accurately.

Ajax Spiralwound gaskets are described on p 116. United States Gasket Co.

PIPE, TUBING & HOSE

Key No. 536—Cat 500 contains data on seamless & interlocking hose in bronze, steel & stainless steel. Atlantic Metal Hose Co. p 127.

Key No. 537—Piping Layout No. 66 contains data on piping connections for air-washer air conditioning system. Jenkins Bros. p 9.

Key No. 538—Hanger Catalog contains complete data on adjustable pipe hangers and supports. Grinnell Co., Inc. p 53.

Literature available on Ric-wiL prefabricated insulated piping. The Ric-wiL Co. p 99.

PUMPS & COMPRESSORS

Adv. p 36 contains information on centrifugal pumps by Worthington Corp., Centrifugal Pump Div.

Air compressor installation with the Schramm unit system is described on p 115. Schramm, Inc.

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Key No. 539—Bulletin gives full application and specification data on De Laval boiler feed pumps. De Laval Steam Turbine Co. p 56.

Key No. 540—Bull 553 contains story on Milton Roy motor-driven controlled volume pumps and their application. Milton Roy Co. p 61.

Adv. p 38 contains information on Worthington YC-2 compressors. Worthington Corp., Compressor Div.

Key No. 541—Catalog available on Orchem chemical pressure pumps and package systems. Orchem Pump Div. p 122.

REFRACTORIES

Adv. p 121 contains information on Super #3000 refractory cement. Refractory & Insulation Corp.

Information available on Lumnite for refractory concretes. Lumnite Div., Universal Atlas Cement Co. p 92.

STEAM SPECIALTIES

Key No. 542—Coupon on p 2 offers Catalog J listing all Armstrong traps. Armstrong Machine Works.

(Continued on page 118)

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readers' guide

(Continued from page 117

Key No. 543—Coupon on p 106 offers literature describing Coe Drainator steam traps and safety water heater. The Coe Mfg. Co.

Key No. 544—Catalog (or see Sweet's) contains data on Nicholson steam traps. W. H. Nicholson & Co. p 119.

TOOLS

Details are available on the Elliott handhole seat grinder. Elliott Co., Lagonda Div. p 114.

Key No. 545—Send 10c for 68-page catalog of Proto tools. Plomb Tool Co. p 6.

VALVES & REGULATORS

Crane diaphragm valves are described on p 7. Crane Co.

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Literature available on Edward valves with impactor handwheels. Edward Valves, Inc. p 32.

Key No. 546—Bull 365 contains data on Powers shower regulators. The Powers Regulator Co. p 125.

Key No. 547—Valve catalog contains data on Rockwell butterfly valves. W. S. Rockwell Co. p 123.

Key No. 548—Bulletin describes Darling revolving disc gate valves. Darling Valve & Mfg. Co. p 58.

Key No. 549—Catalog describes reduction of repairs with Sims pump valves. Sims Pump Valve Co., Inc. p 101.

Key No. 550—Full details on Spence temperature regulators is given in Bull T50. Spence Engineering Co., Inc. p 46.

Key No. 551—Catalog No. 50 describes the Chapman motor unit for positive control of large valves and sluice gates. The Chapman Valve Mfg. Co. p 44.

Details are available on boiler feed regulators. Henszey Co. p 119.

WATER TREATMENT & WASTE DISPOSAL

Key No. 552—Amine treatment for corrosion protection is described in Bull CP 100. The Bird-Archer Co. p 103.

Key No. 553—Coupon on p 120 will bring complete details on the Chlorinizer slime control system. Builders-Providence, Inc.

Complete details available on the Nalco Service Agreement. National Aluminate Corp. p 13.

Key No. 554—Bulletin describes Inversand water softening system. Hungerford & Terry, Inc. p 101.

Key No. 555—Free technical paper No. 98 "Boiler Scale—Its Formation and Prevention." W. H. & L. D. Betz. p 17.

Adv. p 25 describes Cochrane automatic demineralizers for silica removal. Cochrane Corp.

Key No. 556—Coupon on p 33 offers Accelator Bull 1825-Y on water treatment. Infilco, Inc.

MISCELLANEOUS

Key No. 557—Coupon on p 117 offers free book on the Apeco Auto-Stat that produces dry photocopies automatically. American Photocopy Equipment Co.

Adv. p 4 gives information on flame cut shapes cut to your exact specifications. The Foster Co.

—*End*

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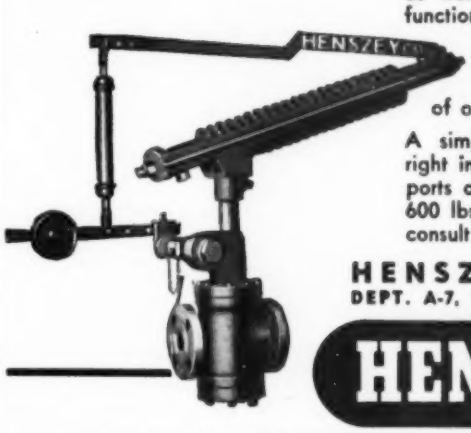

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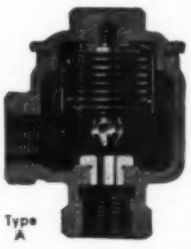
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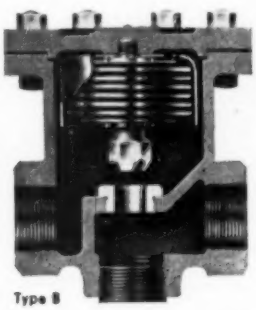
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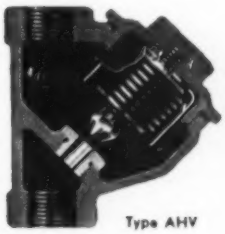
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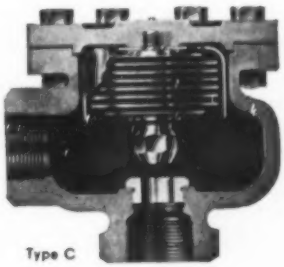
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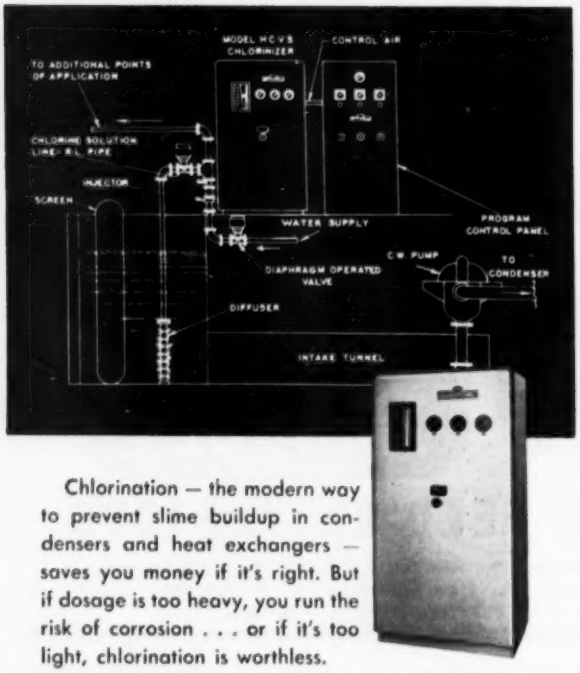

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quick reference

to bulletins & catalogs

Page No.	Advertiser	Catalog	Key No.
127	Acme Electric Corporation	Voltage regulators	515
117	American Photo Equipment Co.	Apeco Auto-Stat	557
124	Ames Iron Works Inc.	Amesteam generators	504
2	Armstrong Machine Works	Traps	542
127	Atlantic Metal Hose Co.	Flexible metal hose	536
17	Betz, W. H. & L. D.	"Boiler Scale — Its Formation and Prevention	555
103	Bird-Archer Co., The	Amine treatment	552
120	Builders-Providence, Inc.	Chlorinizer slime control system	553
14	Bussmann Mfg. Co.	Dual-element fuses	518
44	Chapman Valve Mfg. Co., The	Motor unit for valves, sluice gates & floorstands	509
35	Cleaver-Brooks Co.	Packaged boilers	509
106	Coe Mfg. Co., The	Steam traps and water heater	543
37	Coppus Engineering Corp.	Blowers and ventilators	520
109	Crane Packing Co.	Packings	535
42	Cuno Engineering Corp.	Flo-Klean filters	521
100	Cyclotherm Div., U. S. Radiator Corp.	"All Your Questions Are Answered by Cyclotherm"	510
58	Darling Valve & Mfg. Co.	Revolving disc gate valves	548
56	De Laval Steam Turbine Co.	Boiler feed pumps	539
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123	Electric Auto-Lite Co., The	Temperature indicators & recorders	528
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26	General Electric Co.	Film "The Vital Link"	516
53	Grinnell Co., Inc.	Pipe hangers and supports	538
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9	Jenkins Bros.	Piping Layout No. 66	537
60	Johns-Manville Corp.	"Johns-Manville Packings for the Power Plant"	534
127	Kano Laboratories	"Genius at Work"	530
39	Leslie Co.	Strainers	522
3	Link-Belt Co.	Coal handling systems	531
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123	Lovejoy Flexible Coupling Co.	Variable speed pulleys	532
125	Mercoid Corp., The	Relay for audible alarm	527
61	Milton Roy Company	Motor-driven controlled volume pumps	540
101	Murray Mfg. Co., D. J.	Grid unit heaters & blast coils	525
119	Nicholson & Co., W. H.	Steam traps	544
104	Northern Blower Co., The	Norblo portable dust collectors	500
122	Orchem Pump Division	Chemical pressure pumps & package systems	541
29	Orr & Sembower, Inc.	Powermaster with Voriflow	502
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110	Superior Combustion Industries, Inc.	Steam generators	507
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52	Vogt Machine Co., Henry	Tube condensers	524
34	Western Precipitation Corp.	Mechanical-Electrical precipitator (CMP unit)	501
28	Wing Mfg. Co., L. J.	Steam turbines	519
62	Yarnall-Waring Co.	Water gages & illuminator	503

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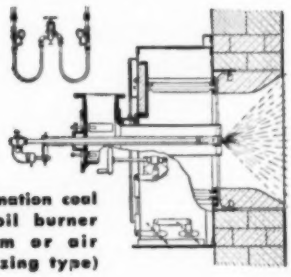
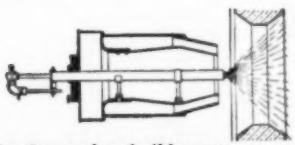


Combination coal and oil burner (Steam or air atomizing type)



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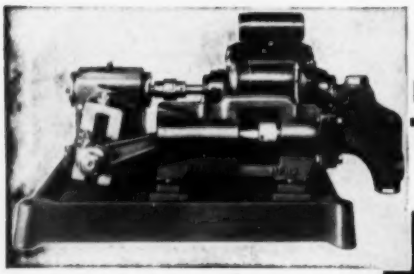

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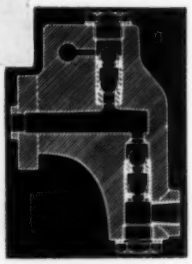


New ball and seat design of "Injecto" has two balls—two seats—in one complete unit. Low in cost — easily replaced.

Performance—plus practical features—make Orchem Pumps a logical choice for chemical pressure applications. Of proven basic design, they still offer features that give you unusual operating flexibility.

One of these is a choice of Manajust Stroke Adjustment—for varying capacity when pump is not operating—or Autajust—for precise control of flow *while pump is running*. Other optional features include Automatic Electronic Control Systems.

Also, you can select from a maximum of variable capacities—from 1 pint to 3,000 GPH—with pressures to 30,000 PSI.

PLUS CHOICE OF "AUTAJUST" OR "MANAJUST" STROKE CONTROL

ORCHEM PACKAGE SYSTEMS

To suit your application, Orchem Pumps are available in complete package systems, including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gallons, complete with all accessories. Special combinations can be built to specifications.

Above—Autajust is variable while pump operates. See Manajust design on pump at top.

Picked for performance by many large firms, Orchem Pumps will give you excellent performance too. Write for Catalog.

ORCHEM PUMP DIVISION

4434 SALMON ST., PHILADELPHIA 37, PA.

spot news

(Continued from page 100)

able to report conditions as they discovered them without the necessity for returning to the surface. In addition, they were able to receive instructions while on the job, and could order tools and equipment sent down to them.

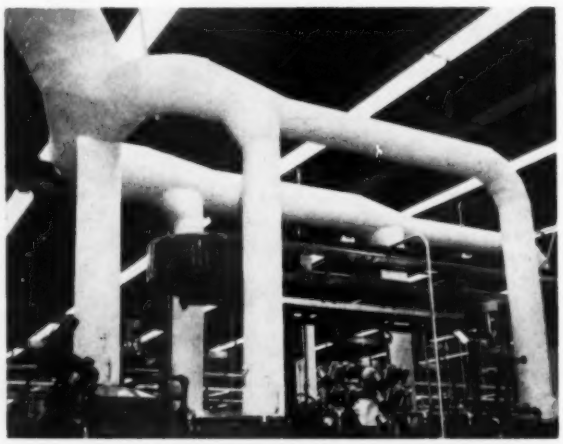
Equipment used in this particular application is manufactured by Mine Safety Appliances Co. An interesting feature of the units, known as Maskfones, is that no outside source of power is required for voice transmission, even over miles of connecting cable. Vibration of the speaker's voice provides the power needed. A cable connects the mask transmitter with a supervisor above ground, who uses a conventional hand-held phone.

New Process Recovers Waste Liquor From Sulfite Pulp Mills

Recovery of waste liquors from sulfite pulp mills is possible as the result of a new process described at a recent joint meeting of the American Institute of Chemical Engineers and the Chemical Institute of Canada. Named the Sulfox process, derived from sulfur oxidation, it is said to adapt a process which has been used in sulfate mills for a long time. It can also be applied to neutral sulfite pulping, a method of pulping hardwoods which is rapidly coming into wide use.

There are about 60 mills in Canada and the United States that now dump their spent liquor. For these, the new process appears to offer a practical solution to waste disposal problems. The process involves evaporating and burning the spent liquor to an ash in the same type of equipment now used in kraft mills. This is practical because common

(Continued on page 124)



HUGE EXHAUST SYSTEM SERVES NEW ENGINE PLANT

Resembling the grotesque shape of a prehistoric monster, exhaust stacks in Chrysler Corporation's new engine plant at Trenton, Mich., serve a valuable purpose by carrying off fumes from a new automatic piston plating operation.

JOBS LIKE THESE!

Lovejoy Countershaft Unit controls speed of automatic Spring Coiler

Lovejoy Wide V-Belt Pulley included in design of Tapping Machine

...depend on

LOVEJOY VARIABLE SPEED PULLEYS

Whatever *your* job calls for — you, too, can depend on Lovejoy Variable Speed Pulleys to operate machinery at exactly the right speed. Quick, easy, finger-tip control — no stops for speed changes. Simple installations on old or new equipment. Shipped from stock for fractional to 8 H.P. duties. And ask about the new, low-cost Lovejoy Tilting Motor Base for fractional motors up to ¾ H. P.

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W. S. ROCKWELL Butterfly Valves

Minimum Pressure Drop

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Automatic or Manual Control

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for Any Operating Condition to 300 p.s.i. and 2000° F.

•

of any metal or rubber-lined in sizes to 120"

Rockwell 42" standard butterfly valve with hydraulic cylinder and counterweight for automatic operation.

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Model F-1 temperature indicator—Rigid stem or capillary tubing for EYE-LEVEL remote reading. Priced from $22.

THE ELECTRIC AUTO-LITE COMPANY

INSTRUMENT AND GAUGE DIVISION

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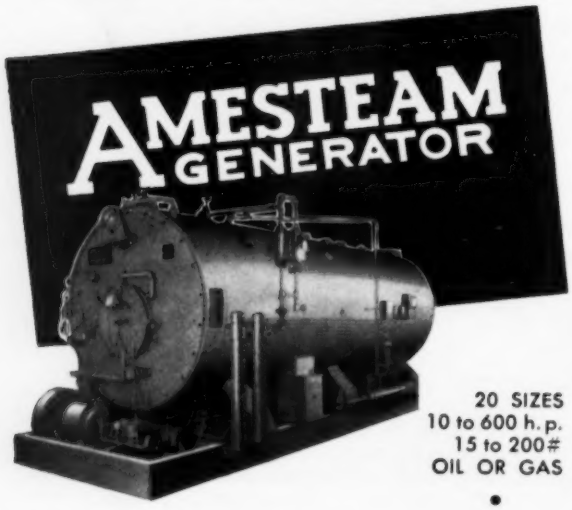
TEMPERATURE INDICATORS & RECORDERS

REAL SAVINGS

in installation . . . in operation with these "PACKAGED" BOILERS



20 SIZES
10 to 600 h. p.
15 to 200#
OIL OR GAS

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JUST SET IT ON YOUR CONCRETE FLOOR — no special foundation or heavy stack are needed. You make BIG savings on installation of AMESTEAM GENERATOR because it's a complete, self-contained unit, ready to start generating steam!

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Box G-73 Oswego, N. Y.
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NAME.....
COMPANY.....
ADDRESS.....

AMES IRON WORKS INC.

BOX G-73 OSWEGO, N. Y.

spot news

(Continued from page 122)

soda is used in place of the lime, dolomite, magnesia, or ammonia now used in sulfite mills. Its use does not impair quality of the pulp and, in fact, there is some evidence that such a pulp has advantages.

As in kraft mills, the ash is a mixture of sodium sulfide and carbonate. The sulfide is oxidized to sulfite by a procedure which the inventors have reduced to a surprisingly simple operation. This is fortified with sulfur dioxide in equipment already available at all sulfite pulp mills. Any soda lost in the cycle is added, and the end result is the cooking liquor ready for the mill.

Fork Truck Reduces Man-Hours Required to Handle Coal

Union Steel Products Co. reports a reduction of 96 man-hours per week in the stoking of furnaces has been affected at its Albion, Mich., plant. Cost of stoking and maintaining the furnaces had constantly exceeded the allotted budget, and the company was faced with the problem of effecting at least a $100 economy while maintaining efficiency.

This has been accomplished by using a 4000 lb capacity, pneumatic-tire fork-lift truck, manufactured by Clark Equipment Co., to transport coal from an outside storage area to the spreader stokers. One man on each shift handles the entire operation with ease, and the truck, which is equipped with a 15 cu ft shovel attachment, is in use 24 hours each day. Chains are used in bad weather. Despite the extremely cramped working conditions in the boiler room, the truck is sufficiently maneuverable to perform in an efficient, easy-to-handle manner.

—*End*

for hand hole cover plate studs, etc... LEADING

BOILER MFRS. & USERS

now standardize on

C-5 "HI-TEMP" THREAD COMPOUND

√ speeds up dis-assembly time!
√ prevents stud breakage!
√ eliminates pitting of stainless steel!

Leading boiler mfrs. and users have proved through extensive tests that coating all hand hole boiler cover plate studs with Fel-Pro C-5 "Hi-Temp" will effect a substantial savings in time, labor and costly stud breakage.

Fel-Pro's exclusive Colloidal-Copper formula allows for easy separation and reduces stud breakage of threaded assemblies after long exposure to extreme temperatures. It eliminates galvanic pitting of stainless and alloy steel even where dissimilar metals are joined.

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NO MORE FROZEN OR GALLED STUDS EVEN AT 1800° F

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#16s IFP

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—scalding hot!

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Use POWERS THERMOSTATIC Water Mixers

BUT THIS

Real comfort and safety. No waste of time or hot and cold water.

POWERS THERMOSTATIC WATER MIXERS

—eliminate shower accidents

They are completely automatic, hold shower temperature wherever you want it regardless of **pressure** or **temperature** changes in water supply lines. Failure of cold water instantly shuts off the shower.

Tests prove Powers is safest shower regulator made for factories, schools, hospitals, hotels and clubs. Thousands now in use.

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THE POWERS REGULATOR CO.

Skokie, Ill. • Offices in Over 50 Cities • Est. 1891

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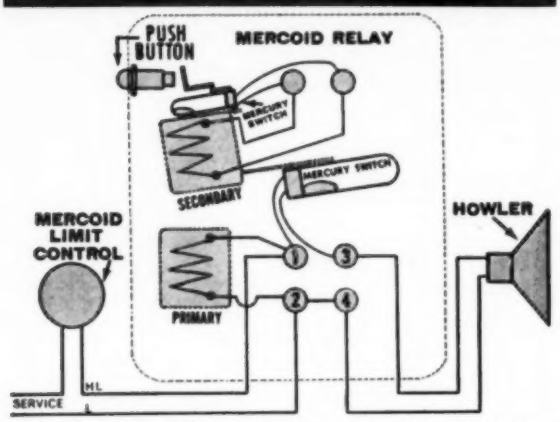

When Limit Control closes its circuit, current is supplied to primary coil of Mercoid Relay and through the normally closed mercury switch to the "Howler" (alarm). To stop "Howler," operator pushes in "push button" which manually raises relay secondary and breaks circuit to "Howler." Secondary is held up by magnetic repulsion until condition is corrected. When limit control opens the primary circuit of relay, secondary coil drops to normal position and relay is automatically ready for another operation.

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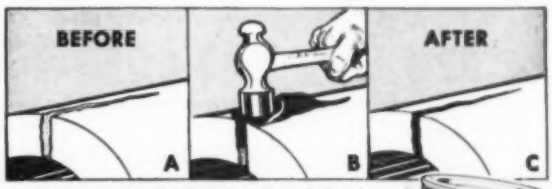
THE MERCOID CORPORATION, 4201 BELMONT AVE., CHICAGO, ILL.



A—Deep crack. B—Tamping Smooth-On in. C—Crack completely sealed.

If You've Never Used SMOOTH-ON, *read this:*

Smooth-On No. 1 Iron Cement is a metallic powder which you mix with water to the consistency of putty. You tamp it, while still soft, into a crack or hole, making sure to force it against all surfaces. With Smooth-On you don't need to use heat or special gadgets. As it hardens, it expands slightly, clinging tightly in place. The required part is ready for use as soon as Smooth-On sets hard. Keep Smooth-On handy for both emergency and routine maintenance repairs. Buy it in 7 oz., 1 lb., 5 lb., 20 lb., or 100 lb. sizes. If your supply house hasn't Smooth-On No. 1, write us.

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ALL SIZES TO FIT YOUR WATER GAGES

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due to VIBRATION, MISALIGNMENT, EXPANSION, CONTRACTION.

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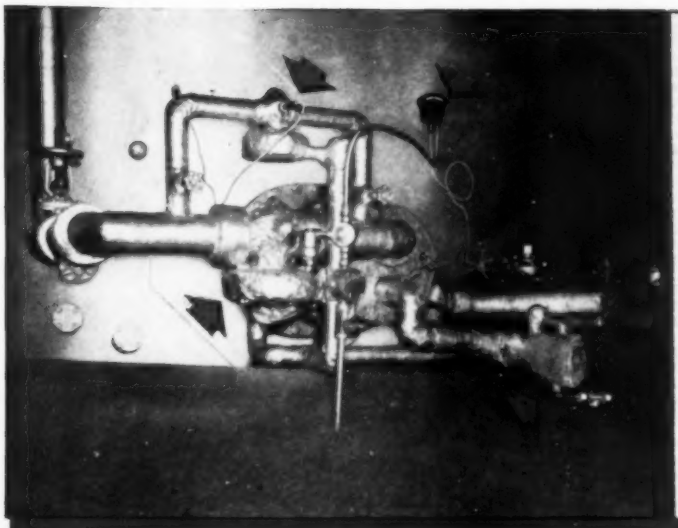
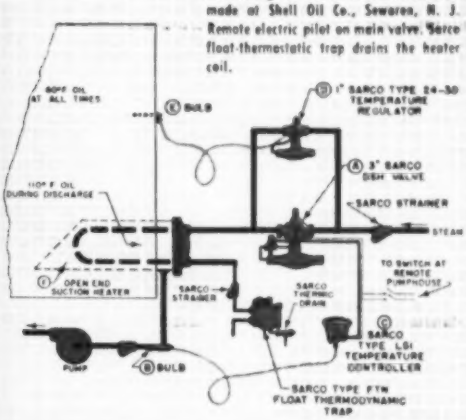
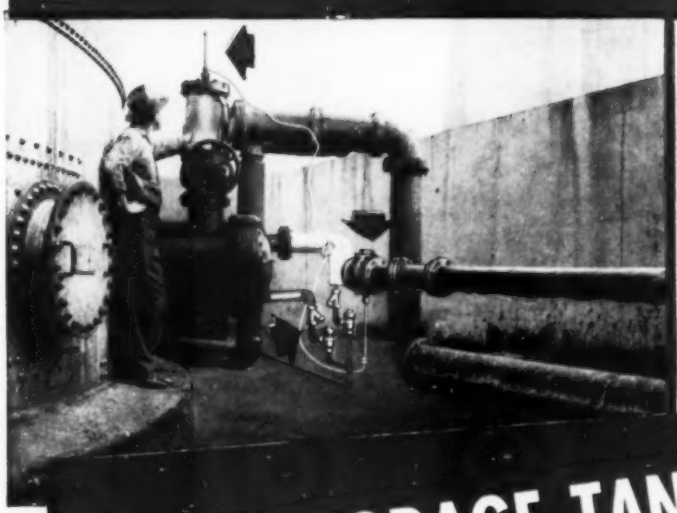
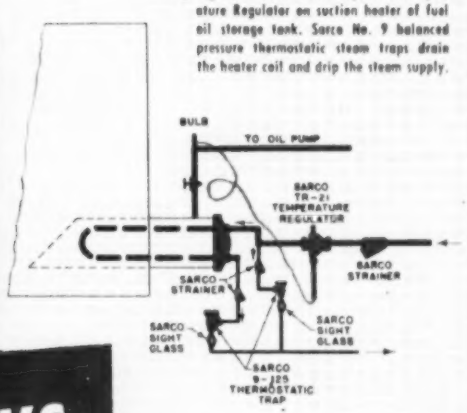


● Fig. 1, Sarco type 24-30 self-contained, pilot-operated Temperature Regulators on bulk storage tanks. One of 13 installations made at Shell Oil Co., Sewaren, N. J. Remote electric pilot on main valve. Sarco float-thermostatic trap drains the heater coil.





● Fig. 2, Sarco TR-21 self-operated Temperature Regulator on suction heater of fuel oil storage tank. Sarco No. 9 balanced pressure thermostatic steam traps drain the heater coil and drip the steam supply.



BULK STORAGE TANKS

● SUCTION HEATERS, as widely used to bring heavy fuel oil in bulk storage to pumping temperature, require *fast acting* temperature control. All the controlling must be done while the oil is drawn off through the heater.

The control valve must be of the dead-end, *tight shutoff* type to prevent running away of the temperature when no oil is pumped out.

Sarco self-contained, pilot operated regulator, type 24-30, (Fig. 1) meets these requirements perfectly and will hold delivered fluid temperature constant within close limits.

Fig. 2 is a simplified hook-up for low pressure steam, using self-operated regulator, type TR-21

Send for a Questionnaire or write for Catalog 600-14, to Sarco Company, Inc., Empire State Bldg., New York 1, N. Y. Branches in principal cities. Sarco Canada Ltd., Toronto 8, Ont.

Sarco self-operated Temperature Regulator, type TR-21, sizes ½" to 8", for low pressure steam.

Sarco pilot-operated Temperature Regulator, type 24-30 for dead-end service and high steam pressure.

A Sarco pipeline strainer should be ahead of every regulator to keep out dirt and scale.

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